Pit and Quarry

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CEMENT-MILL & QUARRY

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Reaches Largest Number of Plants

Vol. XIX | DECEMBER 4, 1929 | No. 5

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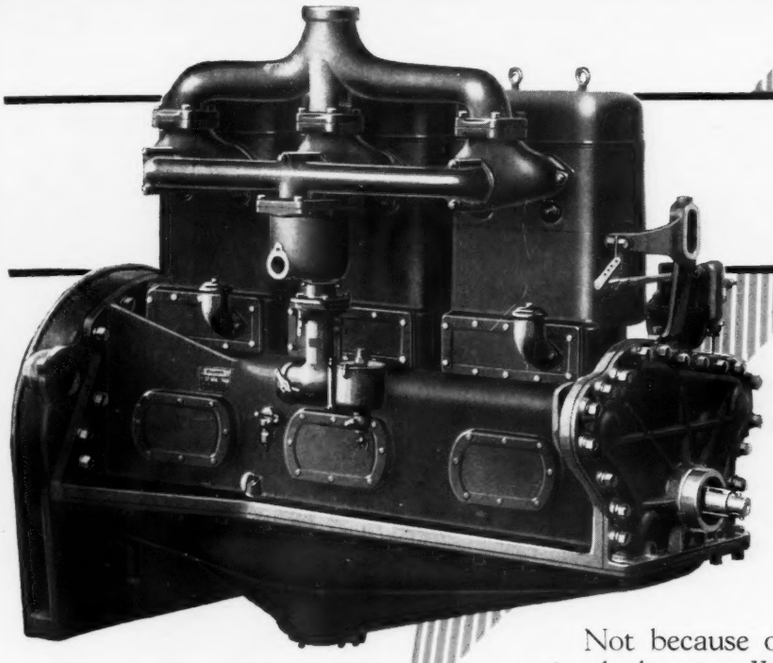

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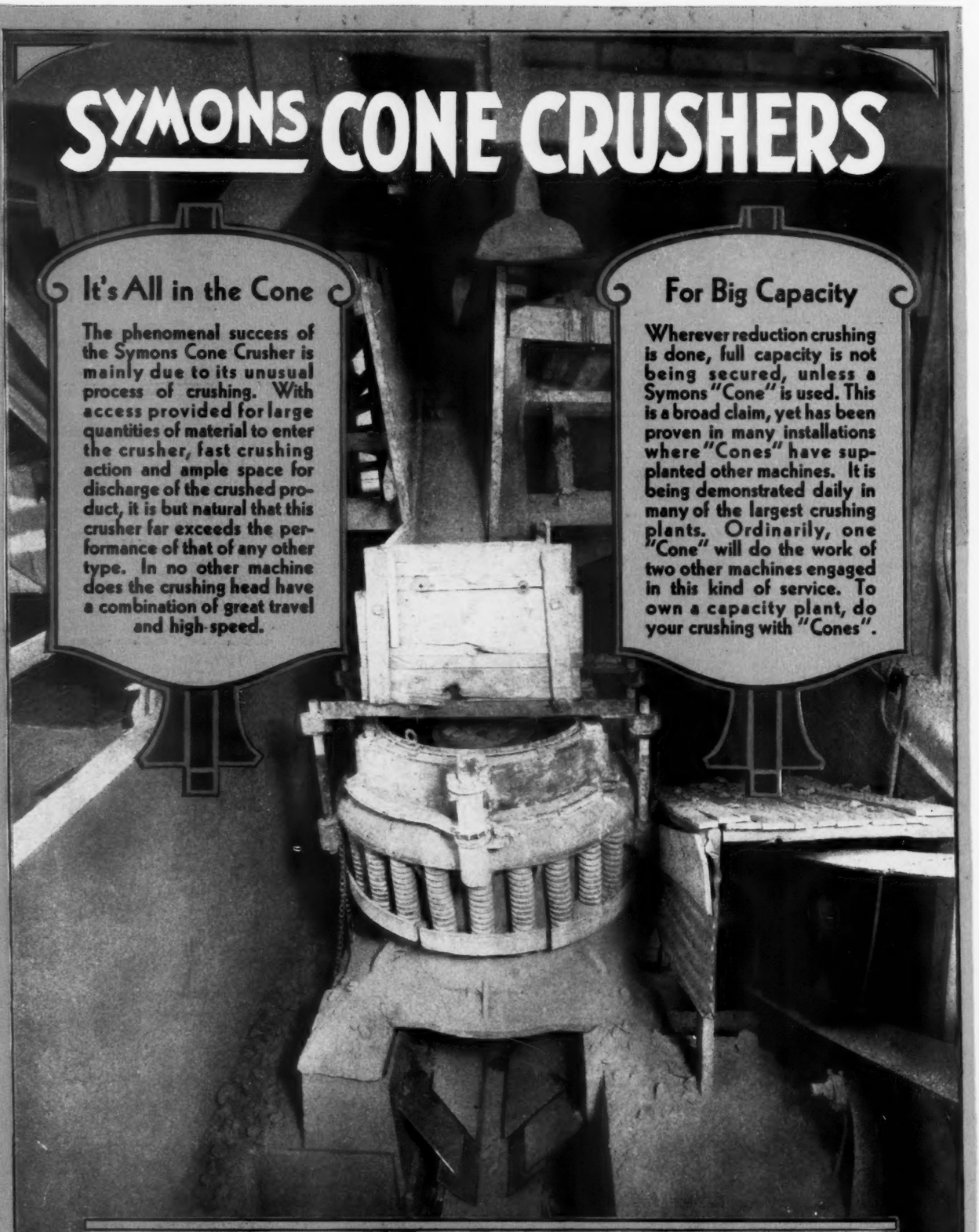

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Vol. XIX CHICAGO, DECEMBER 4, 1929 No. 5

CONTENTS

White Rock Quarries Keeps Abreast of the Times Through a Progressive Program 21

Atlas Portland Cement Company Opens New Plant Near Waco, Texas 30

Silica Forms the Bond of the Earth's Crust and Perpetuates Great Engineering Projects 37

Mining and Treatment of Gypsum at South Australian Plant 43

European Practices in Excavation and Preparation of Sand and Gravel 45

Federal Crushed Stone Company's New Plant Near Buffalo Operates at Capacity First Day 51

Characteristics of Various Types of Primary and Secondary Crushers 59

Phoenix Utility Company Furnishes Mixed Concrete for Hydro-Electric Development 63

General Building Construction With Slag Concrete 68

Sand and Gravel and Central-Mixing Plants Combined by South Bend Company 71

Deposits and Practices in the Land Pebble Phosphate District of Florida 77

Finding the Right Person for the Job by Job Analysis 80

Non-Metallic Mineral Industry Holds Prominent Place Among Exhibits for Proposed Pageant 83

Portland Cement Association Holds Annual Meeting 85

Men of the Industry 87
Personal Mention 90
Insurance Problems Discussed 91
Financial News Corporate and Business 93
Legal Information for Operators 96
Traffic News and Comment 98
Review of Foreign Practice 101
Latest News Flashes 103
New Machinery and Supplies 105

Next Issue December 18, 1929

Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY

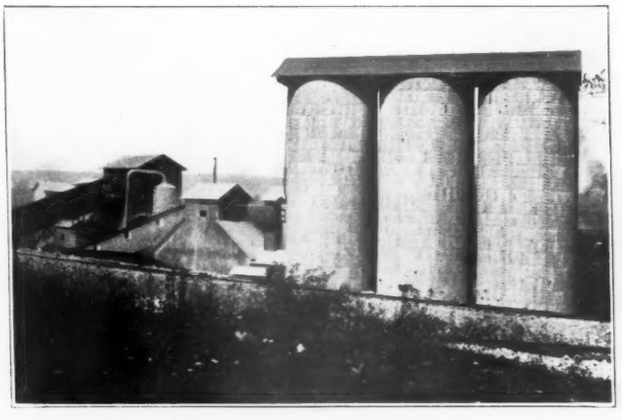
Vol. XIX CHICAGO, DECEMBER 4, 1929 No. 5

Whiterock Quarries Keeps Abreast of the Times Through a Progressive Expansion Program

A Description of the Operations of one of the Leading Eastern Lime and Crushed Stone Producers

BY W. E. TRAUFFER

WHITEROCK QUARRIES, Inc., of Bellefonte, Pa., has built up an enviable reputation in the past five years of operation under the present management. This is, of course, largely due to the uniformly high quality of its products and the sound business principles adhered to, but is perhaps even more because of the cooperation gladly extended at all times to fellow operators in the industry. The company has always been among the leaders in stabilizing prices, discouraging cut-throat competition and unethical trade practices and has always taken an active part in the affairs of the national crushed stone and lime associations.

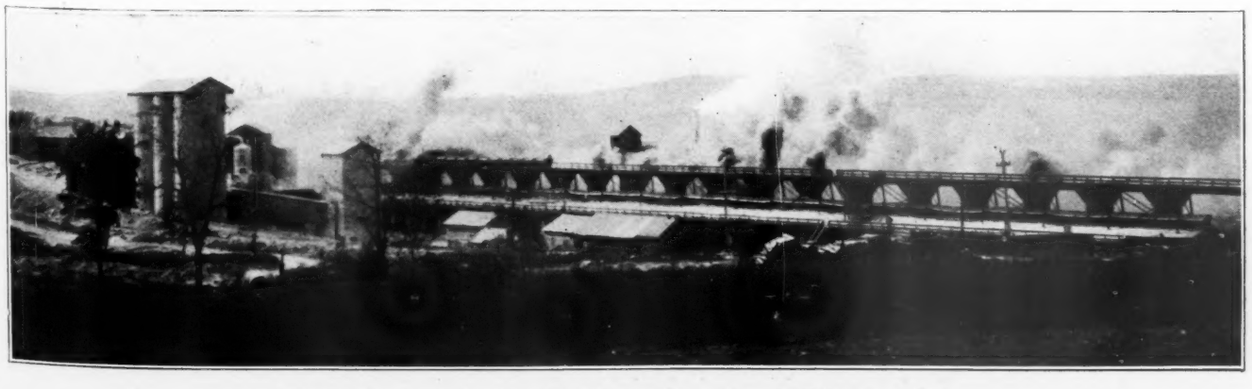


Ground limestone storage bins, with part of plant in background

History and Expansion

The plant is located at Pleasant Gap, Pa., about four miles south of Bellefonte, on the Pennsylvania railroad. The original plant went into operation in 1905 with six lime kilns and a small crushing plant. In 1914 the company was reorganized and the capital stock increased. Twelve additional lime kilns were built and a number of other improvements made. Of the eighteen kilns all except one are yet in operation, having been rebuilt or improved from time to time.

On February 1, 1924, the present management took charge and the entire personnel was reorganized. An expansion and construction program was immediately begun and has been carried out



Plant from southeast with bins and crusher buildings at left

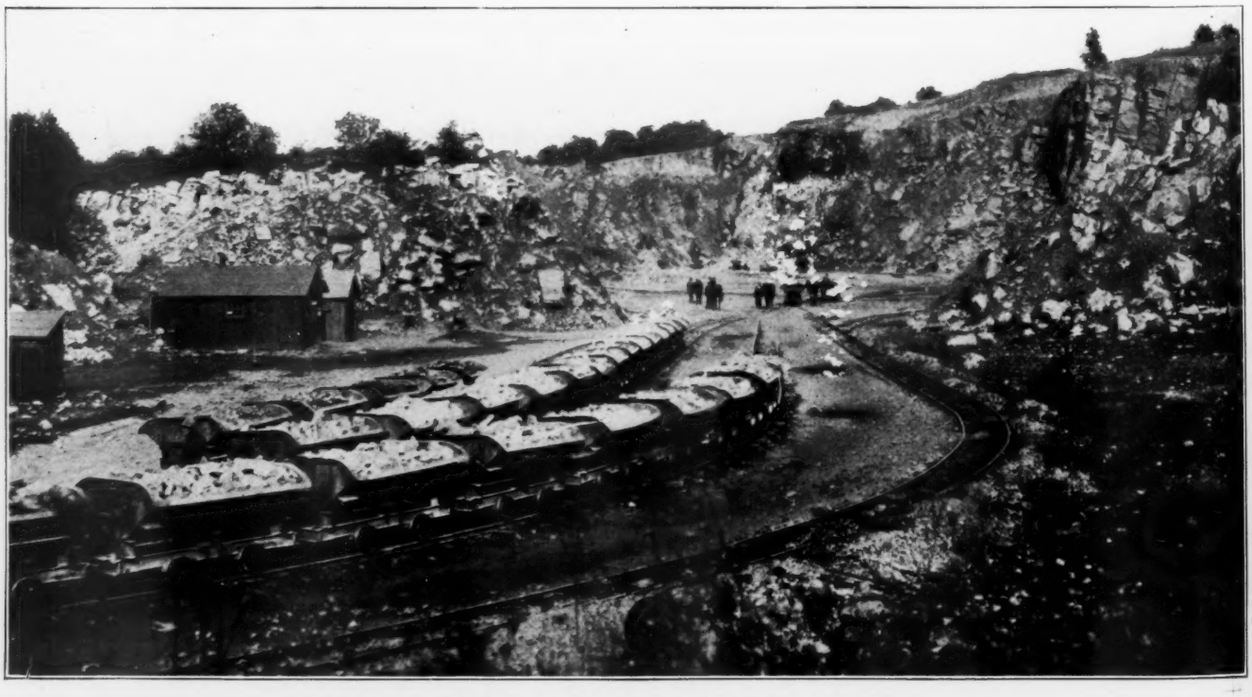
Airplane view of quarries. No. 6 at left and No. 5 at right. Railway to plant in foreground, overburden dump at left

during the past five years, all work being financed out of earnings during that period.

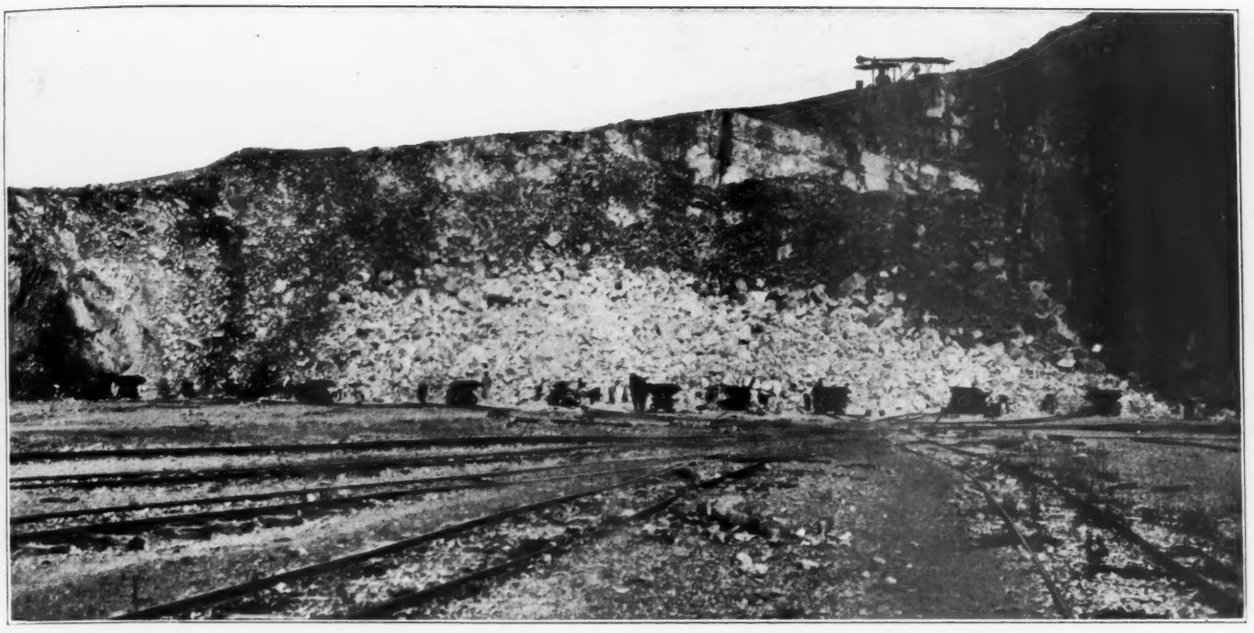
In the period since 1924 the changes made have included the erection of the lime hydrating plant, the lime storage building, a new lime kiln, three pulverized stone storage silos, a machine and blacksmith shop and a storeroom for parts and equipment. In addition, the power house and crushing plant have been rebuilt and considerable new equipment installed. These include three pulverizing units, two compressors, three gasoline locomotives, two steam shovels, a crusher, a tractor, several grinding units and a considerable amount of minor equipment. Practically the entire plant has been electrified during this period. Four years ago the only electrical equipment in the plant was one 3-hp. motor. Now 62 are used, ranging in size from 1-hp. to 200-hp. The program for the next three years calls for considerable expansion in all departments. The first will probably be in the lime plant, where new kilns will be erected. No temporary installations are ever made. All new buildings are of solid fireproof construction with concrete floors and foundations. New installations are so designed and installed as to provide for any future expansion and minimize the amount of reconstruction necessary.

Limestone Deposits

The company's holdings of approximately 900



Loaded cars waiting to be hauled to plant from No. 5 quarry



View of No. 6 quarry, showing results of recent blast

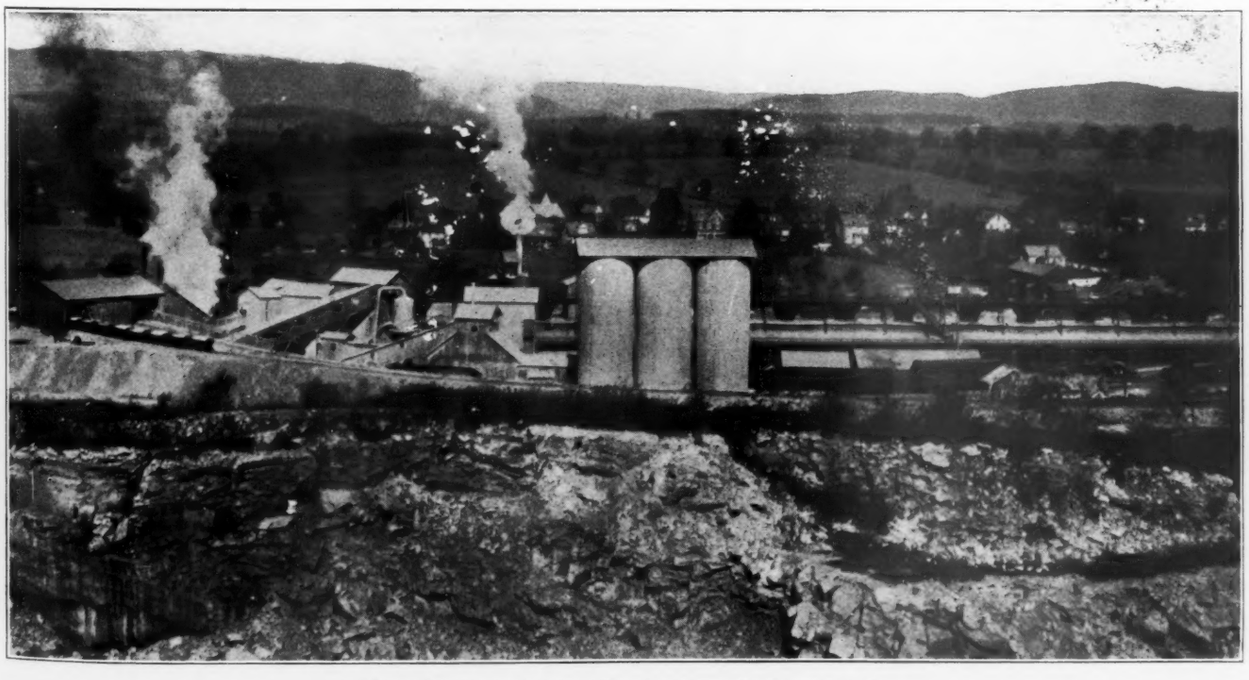
acres of marketable limestone extend for a distance of about 3 miles east and west through the Nittany valley. In addition to these deposits, the company also owns the stone rights on 200 acres of high calcium limestone deposits in the vicinity.

The stone formation in this part of Pennsylvania belongs to the Cambrian-Ordovician age and the strata are estimated by geologists to be 7,200 ft. thick. During this year the company has diamond-drilled at different points to depths of over 1,400 ft. without penetrating the marketable stone. The supply is therefore practically inexhaustible and it is estimated that the plant can operate for several hundred years without having to abandon the present method of open pit quarrying.

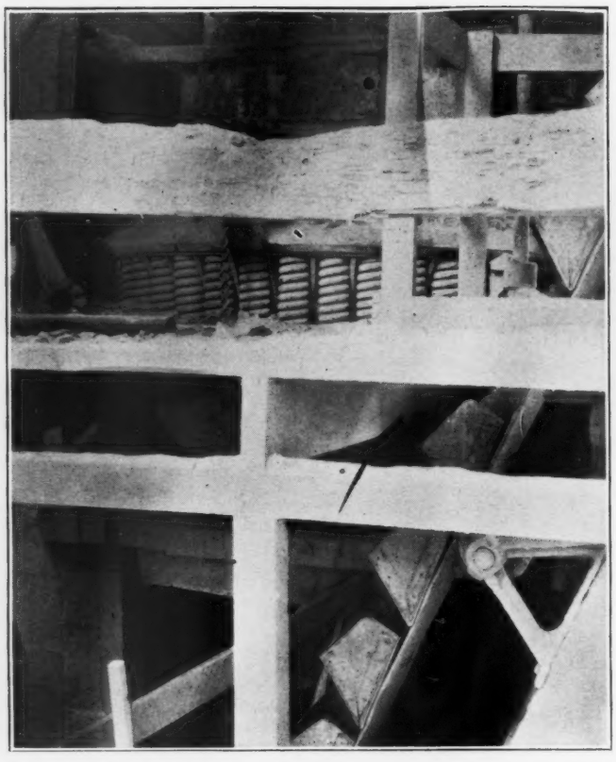
Quarrying Operations

The quarry from which most of the stone is now being obtained is called Quarry No. 6. The stone here has a slight dip to the southeast and an overburden averaging about 2 ft. in depth. This is removed by two Erie Type B ¾-yd. steam shovels and loaded into two 5-cu.-yd. LaPlant Chote steel disc-wheel dump wagons. These are hauled by a Caterpillar 60 tractor to a waste pile and dumped.

The top 30 ft. of stone is a hard black limestone



Plant from south, abandoned quarry in foreground



Secondary crusher and elevator to sizing screens

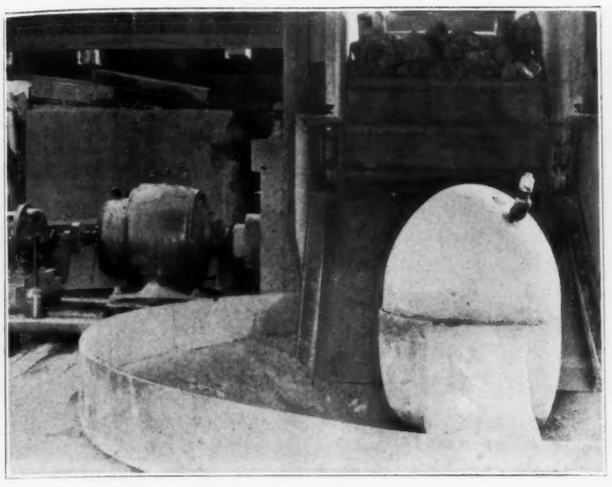
Shovel loading overburden into dump wagon

suitable for crushed stone and blast furnace flux. The stone below this, and all of the stone in one end of the quarry, is high calcium and is used for lime-burning. Blastholes are drilled by a Sanderson "Cyclone" gasoline well drill with an 8-in. bit. Single row bank shots are made on the 80-ft. face using Hercules 40 per cent dynamite and Cordeau-Bickford safety fuse. Fairly good sized shots are made, the last on Oct. 7 of this year bringing down an estimated 30,000 tons of stone.

Secondary drilling is done with two Ingersoll-Rand, three Sullivan, and one Chicago jackhammer drills. The stone is all loaded by hand into 2-cu.-yd. Koppel steel rocker dump cars which are hauled 1½ miles to the plant. Two 8-ton Plymouth gasoline locomotives and 20- and 12-ton Baldwin steam locomotives are used for this purpose, hauling from 18 to 22 cars in a train. Any waste stone is hauled away by a 2-ton Brookville gasoline locomotive and dumped on a waste pile. The total trackage at quarries and plant is over 9 miles.

The No. 5 quarry, which is also being used at this time, adjoins the No. 6 quarry. The stone is very similar and much the same methods are used. The face, however, is about 110 ft. in height, and the quarry floor is about 45 ft. lower than that in

Airplane view of plant from north. One of the temporarily abandoned quarries in background



Primary crusher with plate feeder and drive

No. 6 quarry. This level is being cut into the adjoining quarry as a lower level and eventually both quarries will be worked as one. Four Sullivan tripod drifter drills are used here for the lower faces and a Sullivan jackhammer for secondary drilling. The stone is also loaded by hand and the cars hauled over the same track to the plant.

There are also two quarries located on the hillside immediately above the plant, which are closed temporarily. They are similar to the two quarries which have been described, and the same methods of drilling and blasting are used.

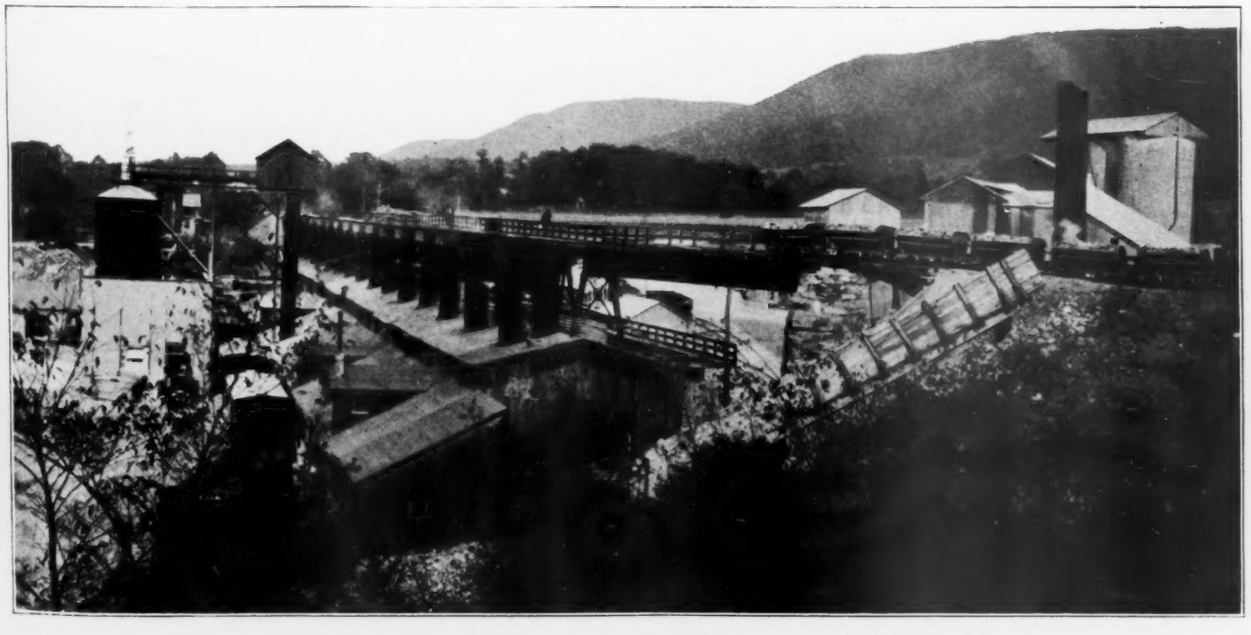
Crushing Plant Operations

All of the trains, regardless of the kind of stone they contain, are hauled over a track on a steel trestle on top of the lime kilns, which are on a level with the track from the quarry. After being discharged, the cars are hauled around by another route, joining the quarry track again beyond the

The sizing screen with elevator from secondary crusher

kilns. The cars of stone for the kilns are dumped directly into them. Some one-man-size stone is also dumped through a chute near the plant directly into railroad cars and is shipped for use in open-hearth furnaces.

The cars of stone for the crushing plant are discharged from either of two tracks in the primary crusher house into a steel track hopper. This has a steel partition in the center which keeps the stone



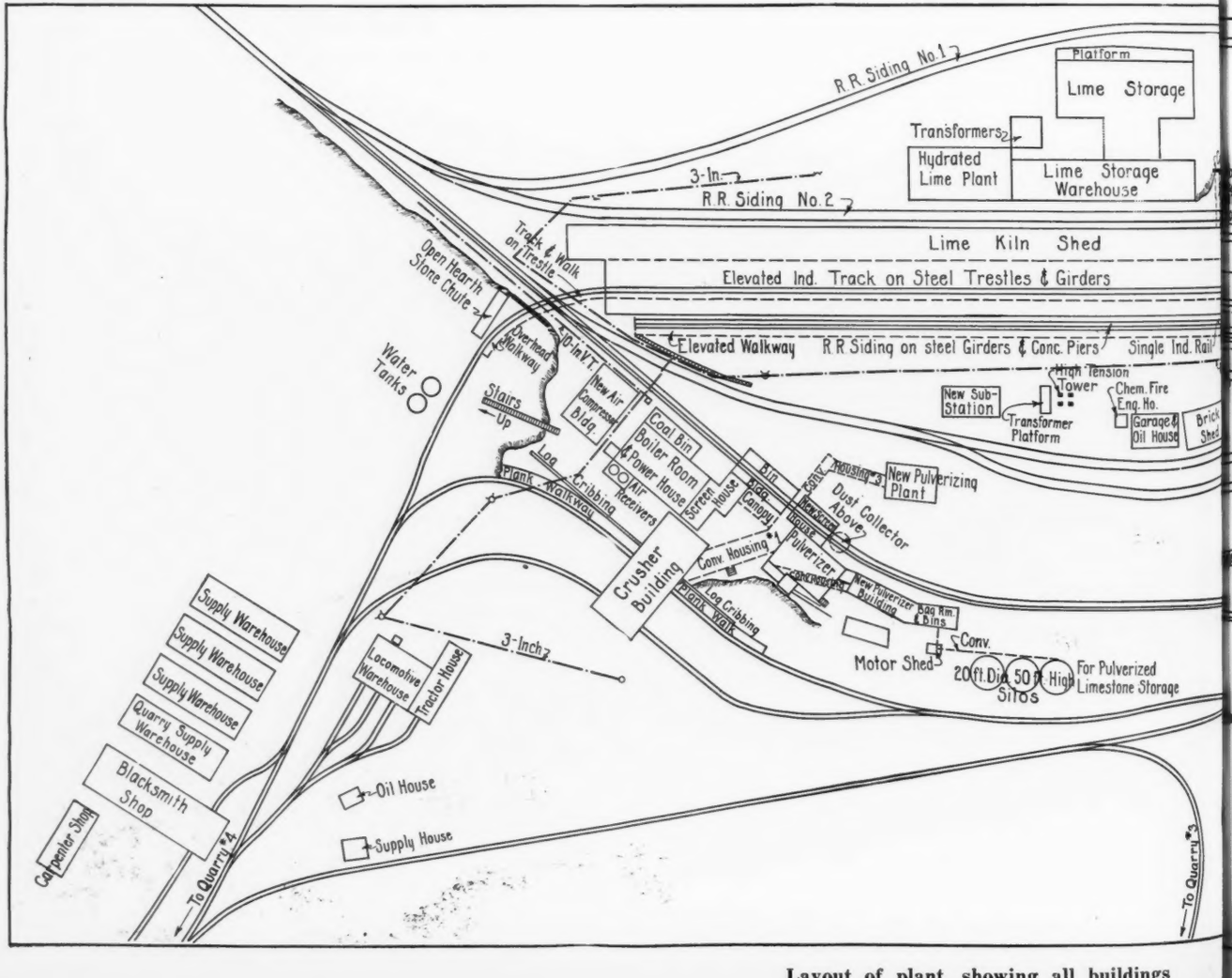
Plant from west with chute for loading direct to cars in foreground

Train of cars being dumped into primary crusher

from bridging. A Webster 48-in. inclined pan feeder on 44-ft. centers discharges the stone into the Allis-Chalmers "Gates" No. 7½ gyratory primary crusher. This, in turn, discharges onto a 4-ft. by 5-ft. Hum-mer single deck vibrating screen which is used as a scalper. Screen cloth of from ¾-in. to 2½-in. mesh is used as conditions require. The oversize goes onto a 30-in. inclined belt conveyor on 93-ft. centers which discharges into the Allis-Chalmers 60-in. by 12-ft. revolving scalping screen. This may be used with 3-in. or 6-in. perforations, according to the size of stone required. The oversize from this screen goes to a Symons 4-ft. cone crusher which was installed in 1928.

The pan feeder is driven by a 10-hp. General Electric motor through a Foote spur gear speed reducer with a ratio of 128.8 to 1. The primary crusher and secondary crusher are both belt-driven by a Chandler and Taylor 180-hp. steam engine. The revolving screen is driven by a 40-hp. General Electric motor.

The discharge from the Symons cone crusher, along with the material passing through the Hummer screen, is carried by a 78-ft. centers Allis-Chalmers belt bucket elevator with 14-in. buckets to the top of the screening plant. This elevator is driven from the same motor as the two crushers. It discharges onto a Niagara 3-ft. by 6-ft. triple deck vibrating screen which divides the stone into sizes of from ⅛-in. to 2¾-in. The product of this screen is chuted to three 75-ton capacity wooden storage bins for road, concrete and flux stone. This screen is Texrope driven by a 5-hp. motor. The



Layout of plant, showing all buildings

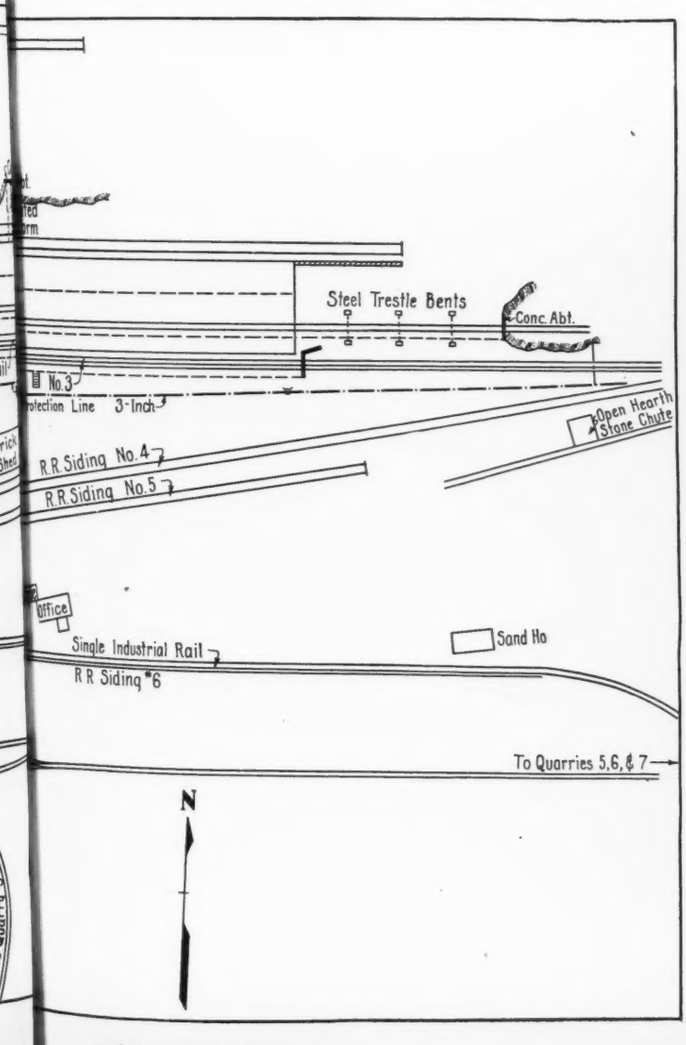
3-in. or 6-in. oversize from the scalping screen goes to a fourth bin of the same type but with a capacity of 150 tons. This stone is also used for flux. All of the bins discharge through gates to either trucks or cars.

The Pulverized Stone Plant

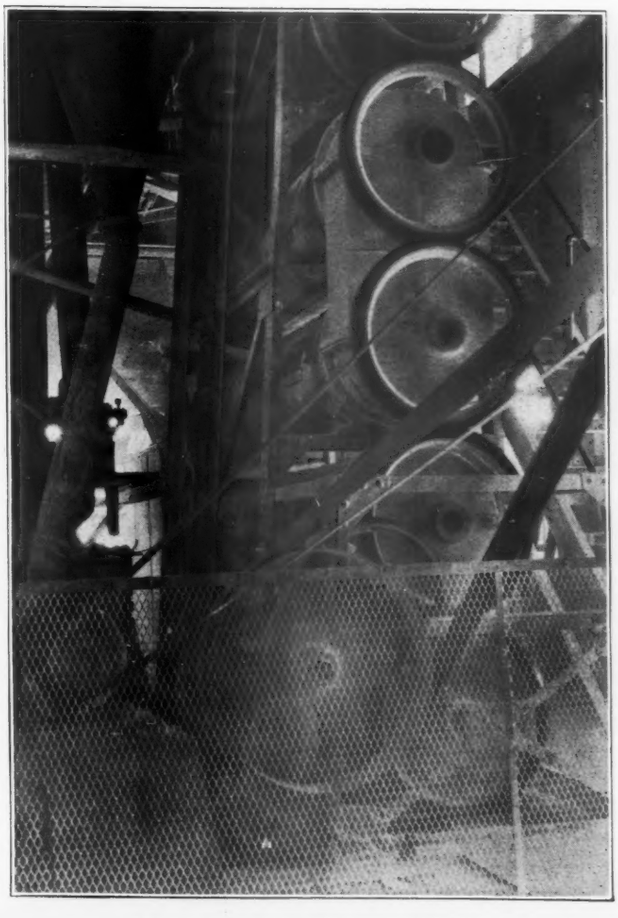
The stone from the concrete stone bin can be discharged into a bucket elevator to the pulverized stone plant. This feeds by two 14-in. belt conveyors to a Kent "Maxecon" pulverizer and air separator. This is Texrope driven by a 50-hp. General Electric motor. The coarse dust from the separator goes by belt conveyor to two Hum-mer double-deck vibrating screens which produce three sizes and oversize. The three sizes, agstone and two sizes used in glass making, go direct to three 50-ton capacity wooden bins for shipment. The oversize is returned to the Kent mill.

The fine dust from the separator is fed by a 12-in. screw conveyor 38 ft. long to a 5-in. Fuller-Kinyon pump. This feeds through 150 ft. of 2½-in. pipe to three Neff and Fry 1,000-ton capacity concrete stone silos, each 20 ft. in diameter and 50 ft. high. Valves on top of the bins control the discharge. The pump can also discharge through another pipe line directly into a 50-ton capacity wooden bin over the Bates two-tube bagger. The Neff and Fry bins discharge through gates of the same make into a 12-in. screw conveyor which carries the dust to the same 50-ton bin over the bagger. This is driven by a 7½-hp. General Electric motor through a Foote speed reducer. The fine

Supt. W. E. Saxion in front of locomotive shed



and important features



The six-cylinder continuous hydrator

Lime hydrating plant with storeroom at left and kilns at right

dust is used for mine dusting and as an asphalt filler. Another two-tube Bates bagger under the agstone bin allows sacking of this material also. The pulverizing plant, which was built in 1926, is of corrugated metal and wood frame construction. The Neff and Fry bins were installed in 1928.

The Lime Kilns and Hydrating Plant

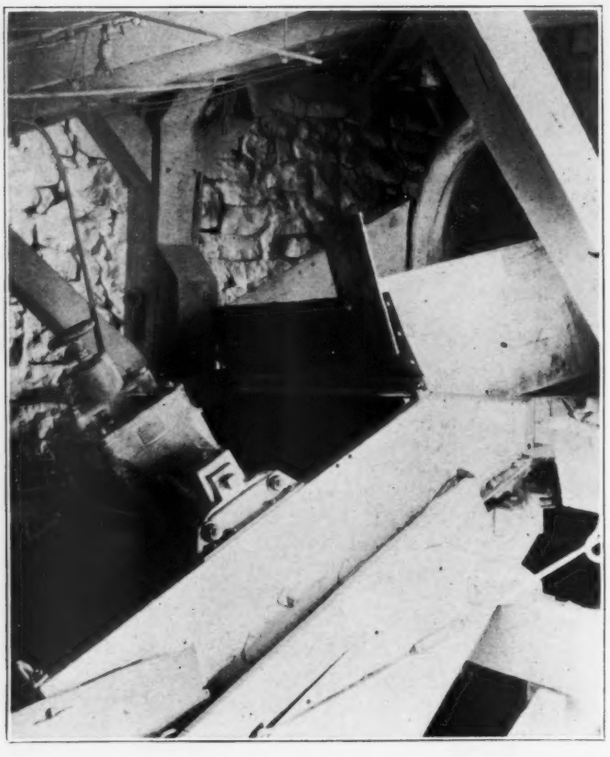
Seventeen of the eighteen vertical lime kilns have all been in operation for 15 years or more, but have all been rebuilt and improved to keep up with modern practice. They are all steel-jacketed and brick-lined, with concrete bases, and are 6½ ft. in diameter by 24 ft. high. The original No. 1 kiln was dismantled a few years ago and replaced by an Arnold and Weigel kiln 8 ft. in diameter and 24 ft. high. This has a capacity of from 9 to 10 tons of lime in 24 hours, as compared to the 8 tons produced by each of the other kilns in the same length of time. They are all coal-fired, hand-stoked and hand-drawn. The kilns are in a single row and, as has been previously mentioned, are loaded from a steel trestle over which all stone from the quarry runs.

The burned limestone from most of the kilns is carried in wheelbarrows to a Sturtevant No. 1½ open-door rotary crusher in a concrete pit near the center of the kiln house. The kilns farthest from the crusher discharge into 2,000-lb. Lowden buckets on an overhead track in which the burned lime-

Discharge from ground limestone bins into screw conveyor

stone is hauled. The crusher is Texrope driven by a 15-hp. General Electric motor. This discharges by a chain bucket elevator on 65-ft. centers to a 12-in. Webster screw conveyor to the hydrating building, where the ground lime is fed into a 75-ton capacity steel tank over the hydrator. A stationary screen over this tank allows the pebble lime to be chuted direct to box cars. Some of the pebble lime can also be diverted to a Raymond burr mill which discharges to two 25-ton steel tanks, from which the lime can be loaded into steel drums or bags for shipment. This is used mostly for chemical purposes.

The 75-ton tank discharges directly into the Kritzer 6-cylinder continuous hydrator, which has a capacity of 8 tons per hour. This discharges by screw conveyor and a Link-Belt bucket elevator to a Raymond air separator. The fine material then goes to a 50-ton steel tank feeding a Bates four-tube bagger. The hydrated lime is packed into 33-, 38- and 50-lb. bags and is used for agricultural, building and chemical lime. The hydrating

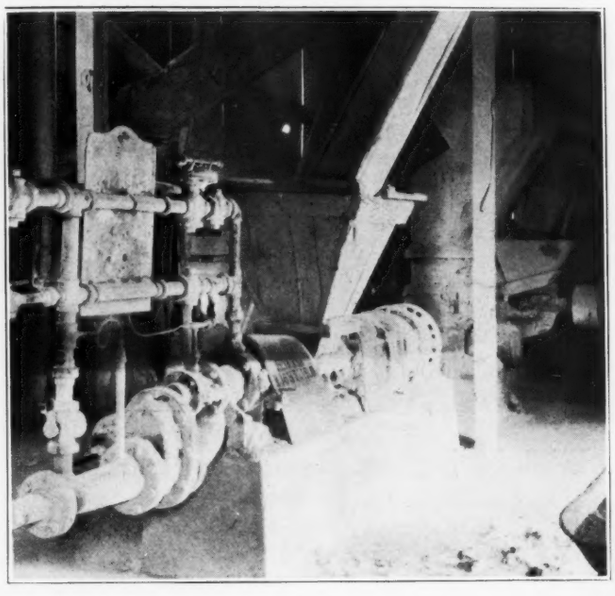


Discharge from primary crusher into vibrating scalping screen

building, which is of all-concrete construction, was built in 1925. The lime is stored in a 75-car capacity storeroom of concrete block construction.

Miscellaneous

Several changes and additions are being made to the plant and, as previously stated, a large expansion program is under way. An additional Kent mill has been installed in a new mine dust building and will be fed from the same bin and conveying equipment as the present mill. In 1924 an Ingersoll-Rand air compressor with a capacity of 732 c.f.m. was installed, but, due to the expansion of operations, an additional compressor became necessary. This was furnished by the Hall Steam Pump Company and has a capacity of 1,230 c.f.m.



Pumping unit in dust house

It will be driven by a 200-hp., 2,300-volt motor and is located in a new concrete block building. New 2,300-volt motors are also being installed to operate the primary and secondary crushers. There is also a completely equipped machine and blacksmith shop and four storerooms for equipment and supplies of all kinds.

The plant office has a Howe 25-ton capacity beam truck scale for weighing out stone for local use and incoming coal from the nearby mines. Most of the shipping is done by rail and the crushed and pulverized stone is shipped almost entirely within the state. Lime products, however, are shipped to eleven different states and some is exported. The plant has a daily capacity of 1,200 tons of crushed stone, 1,500 tons of open-hearth stone, 150 tons of all kinds of hydrated lime and 125 tons of rock dust and agricultural limestones. A considerable quantity of glass-makers' stone is also produced.

An International 1½-ton truck is used for general hauling and a Fordson tractor and dump wagon are used for cleaning up about the plant.

Transformers and power house

Sprout-Waldron belt conveyors and Goodyear conveyor belting are used throughout the plant.

The plant employs about 240 men on all shifts, most of them living in Pleasant Gap. The quarries and the crushed stone plant operate only in the daytime, while the lime kilns, hydrating plant and pulverizing plant operate 24 hours a day.

Power is obtained from the wires of the West Penn Power Company, at 22,000 volts and is reduced by an outdoor substation at the plant to 2,300 volts. This voltage is to be used on several new motors now being installed. The current is further reduced to 220 volts for general plant use.

(*Continued on page* 58)

Mill which produces pulverized limestone for mine dusting

Atlas Portland Opens New Plant

Raw Materials Proportioned by Weight Before Reaching Kiln

By T. K. KNOX
Mining Engineer, Dallas, Tex.

ONE of the most interesting plants in Texas and one that will be watched by the cement industry, is that of the Atlas Portland Cement company (of Texas) located about nine miles outside of Waco, Tex.

Waco is a fast growing town of 80,000 population, located on the black prairie lands of Texas. Texas, and particularly this section of Texas, is enjoying rapid and intensive development in all lines of endeavor. The location affords an abundance of necessary raw material for the operation of the plant for many years, with practically no stripping, and a dependable supply of natural gas if desired.

This is a dry-process plant, which is somewhat unusual in modern construction. A unique feature of the plant is the blending of materials to any desired mix with an accuracy of better than 0.5 per cent.

Another interesting feature of the plant, equally as important as the blending system, is the weighing of all raw materials into the Compeb grinding tube-mills.

The compactness of the whole plant impresses one, and room for expansion has been amply provided. It is a 2,400-bbl.-per-day plant and has functioned with entire success from the start. Construction of the plant was started September 24, 1928, and the first trainload of cement was shipped from the plant June 24, 1929, a remarkable record.

Quarrying

The quarry face has been opened up to a depth of 30 ft. for a distance of 800 ft. The object has been to first open a large length of quarry face and then to dig back into the strata.

The cement rock is the lower portion of the Austin chalk. The shale used is the Eagle Ford shale which immediately underlies the chalk rock in the quarry, but which outcrops and is exposed elsewhere upon the plant property.

The analyses of the raw materials are in per cents

Rock	SiO_2	FeO_3	Al_2O_3	$CaCO_3$	$MgCO_3$
Limestone	5.48	0.85	1.83	87.10	1.72
Shale	54.02	5.76	18.50	9.33	3.34

A Sanderson-Cyclone electric drill is used to sink the shot holes which are placed at about 12-ft. centers. A 50-B Bucyrus-Erie electric shovel with a 1¾-cu. yd. dipper loads the quarry cars. One of these shovels is used also in the shale pit.

Cement Company Near Waco, Texas

The Woodford haulage system is employed in this plant for both the shale pit and the rock quarry. As is generally known, this system embodies the use of individual electric-motor-driven dump cars. Cars operate singly—all car movements being handled by a single operator in a control tower—including the dumping of the cars, which are of 10-cu. yd. capacity.

Crushing

Rock is dumped from the cars into a steel-lined hopper and thence into the crusher. The crusher is fed by a reciprocating table feeder which is driven by a General Electric motor through a speed reducer made by Gears and Forgings, Inc. The crusher is a Pennsylvania No. 60 primary hammer-mill driven by a General Electric slip-ring 350-hp. motor. This hammer-mill is remarkable in the fact that it reduces rock from quarry size to such fineness that no further crushing is required. This is the only crusher employed in the plant.

From the crusher the crushed material feeds onto a Robins belt conveyor which has a 30-in. Goodyear rubber belt. The conveyor is about 265 ft. long. The conveyor is housed and has an inclination of about 18 deg.

From this conveyor belt, material is dumped onto a by-pass conveyor, thence to dryers. Rock is dumped off this long conveyor belt at the same point as is the crushed shale, but it goes to the rock bin which is 32 ft. in diameter by 35 ft. high. From this bin the crushed rock flows by gravity over an Allis-Chalmers table feeder to a conveyor belt which dumps it into a hopper. From this hopper the material is lifted by a vertical elevator to a hopper, from which it is fed to the dryers.

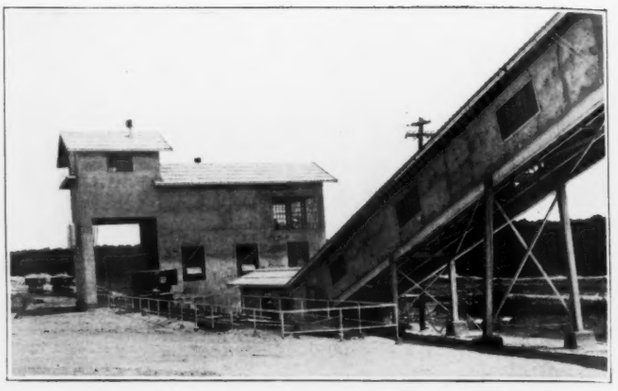
The belts are driven by General Electric motors with Cleveland worm-gear reduction drives.

Drying

There are two Vulcan rotary dryers, each 6-ft. by 80-ft. in size. Exhaust gases from the kiln are used in the dryers. However, if the kiln is not in use, the dryers can be fired with gas. A fan of the American Blower Company, driven directly by a 25-hp. General Electric motor, furnishes the necessary air when gas is used for heating the dryers.

The shale pit

Looking west from crusher building



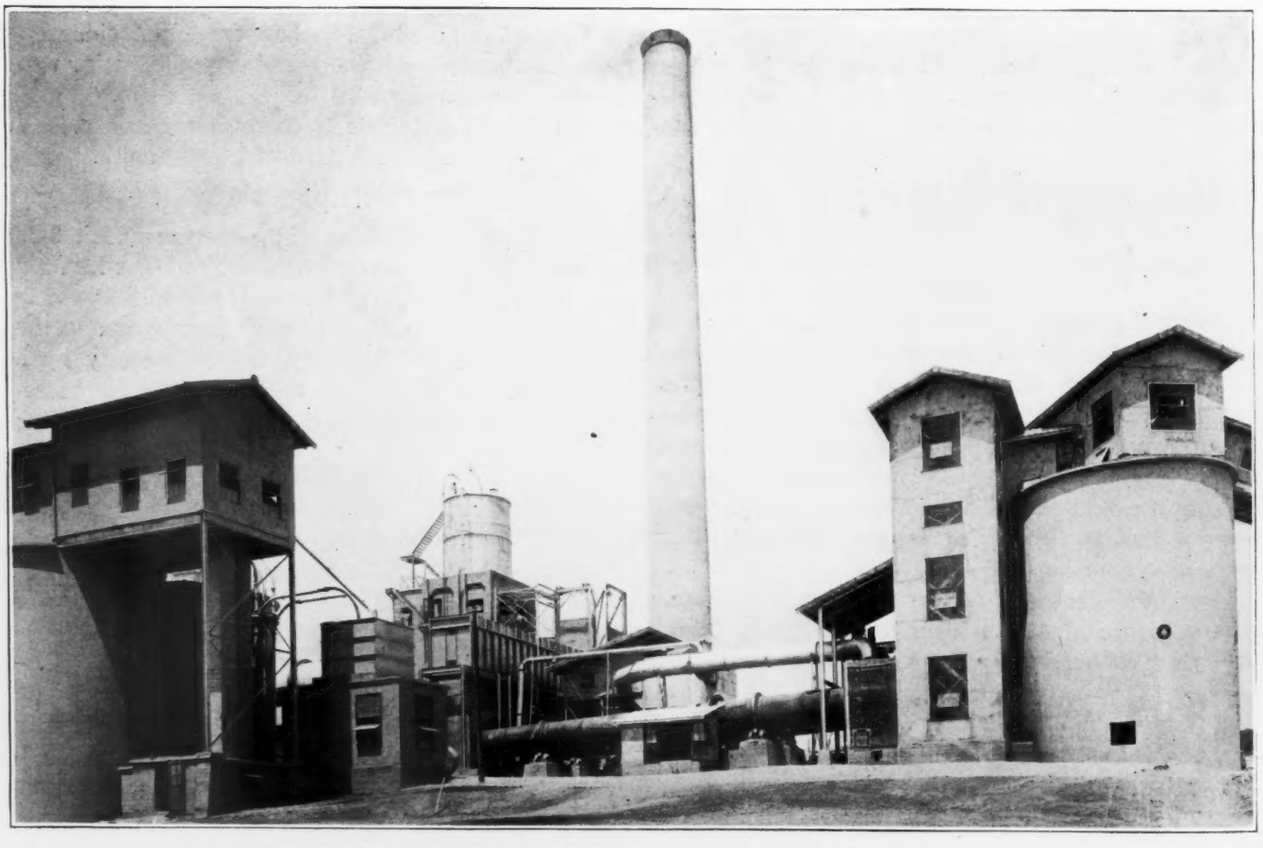
Trackage, crusher building, housed inclined conveyor

The dryers have Tate-Jones gas burners.

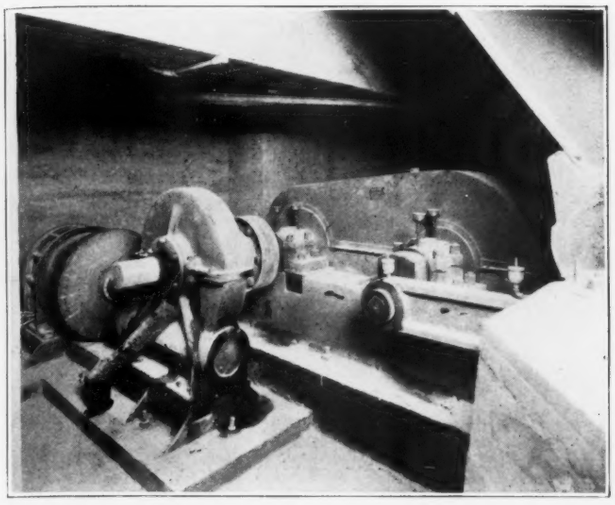
The dryers' gases discharge through a Vorticose Dust Collector made by the Dust Recovery Company. The fan exhausting the gases from the dryers is a Sturtevant and is driven by a General Electric motor of 100-hp., direct-connected. Dust collectors, in fact, are placed at all sources of dust and the collected dust is fed back into the system by screw conveyors. The operations are thus practically free from dust.

From the dryers the material discharges through a chute to a Link-Belt drag-chain which conveys the dried material to a bucket elevator located at the east end of the raw storage silos. There are eight silos so arranged as to form three star or interstice bins. The silos are 26-ft. in diameter by 35 ft. high. Two silos are used for rock storage and two for shale storage. The interstice bins also are used for shale. The remaining four silos serve as composition tanks, to store and to blend the ground material.

The raw storage silos are in line and the bucket elevator discharges onto a belt conveyor which



Partial view of plant, showing dryers and elevated kiln feed tank

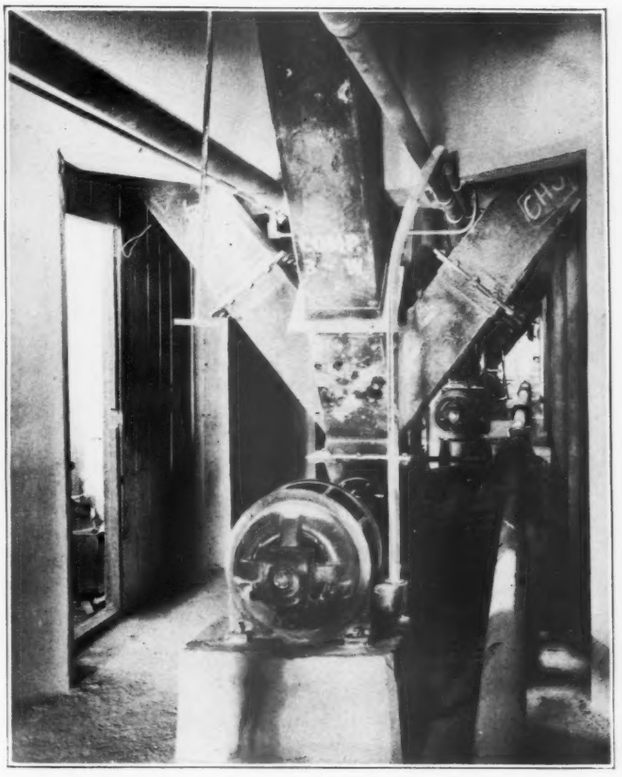


Motor and speed reducer driving crusher feeder

carries the raw material to the desired bin. The raw material is drawn from the silo through an Allis-Chalmers feeder onto a 24-in. conveyor belt which runs the entire length of the silos. At the end of this conveyor belt is an 8-in. by 16-in. vertical bucket elevator which elevates the material to a horizontal belt conveyor, which runs from the silo storage to the hoppers of the raw grinding Compeb mill.

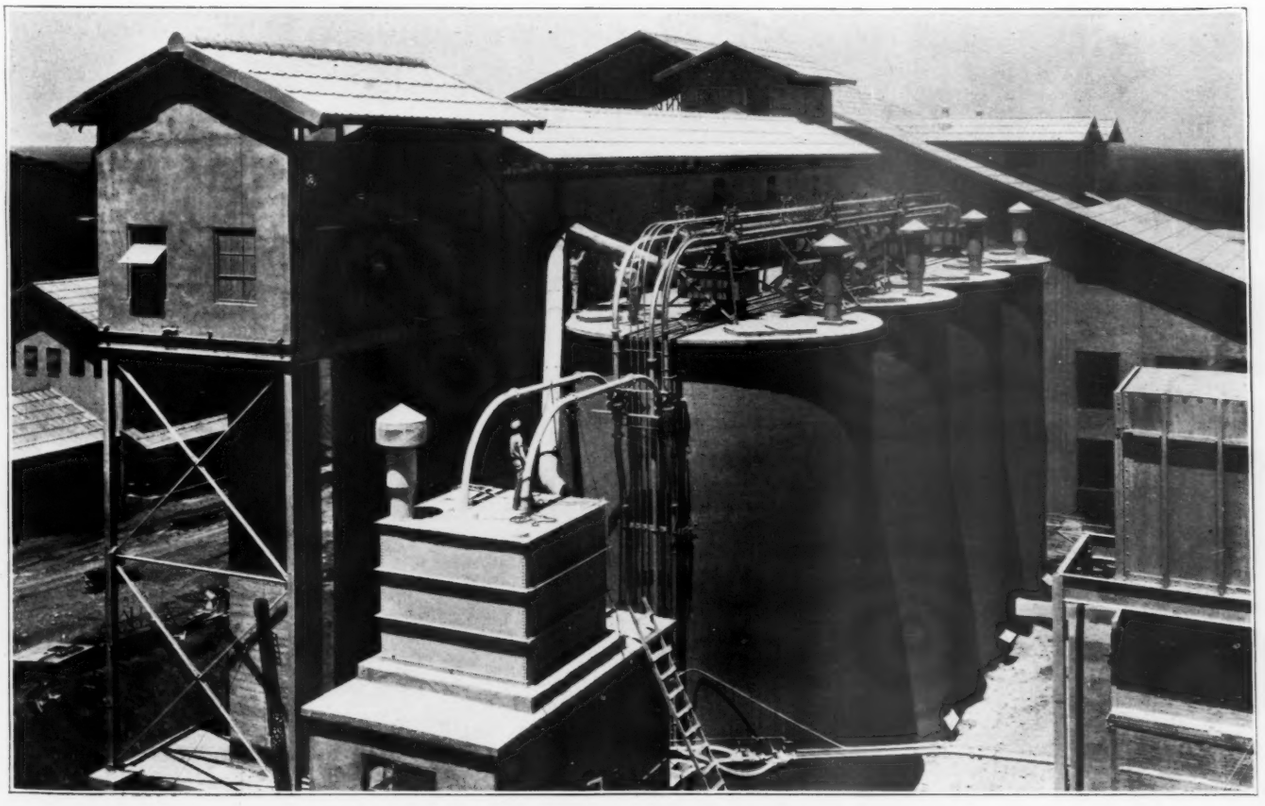
Mixing of Raw Material by Weight

From the hoppers—one for shale and one for rock—the respective materials are fed to the mixing scales. There are two Richardson Scale Com-

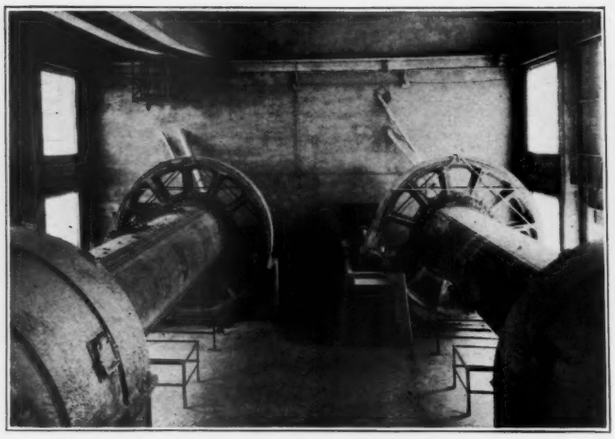


Pneumatic pumping equipment beneath composition bins

pany weighers, the rock scales and the shale scales. These scales are the heart of the plant for, by them, an accurate mix can be obtained. This plant has an absolute, positive control over its raw mix in this manner, as previously explained. From



Showing piping for pneumatic system, on composition silos



Finish mill (left) and raw mill (right)

the scales the materials are fed to the raw Compeb mills.

Fine Grinding

The raw grinding mill and the finish mill are located in the same building, which is alongside the clinker storage and the crane-way.

The mills are Allis-Chalmers Compeb mills, each 8 ft. by 7 ft., and 45 ft. in length, and driven by a 900-hp. synchronous Hytork Allis-Chalmers motor. From the raw mill the material is delivered to the composition silo tanks by Fuller-Kinyon pumps. The finish mill is similar to the raw mill. From the finish mill the cement is pumped by a Fuller-Kinyon pump to the cement storage silos.

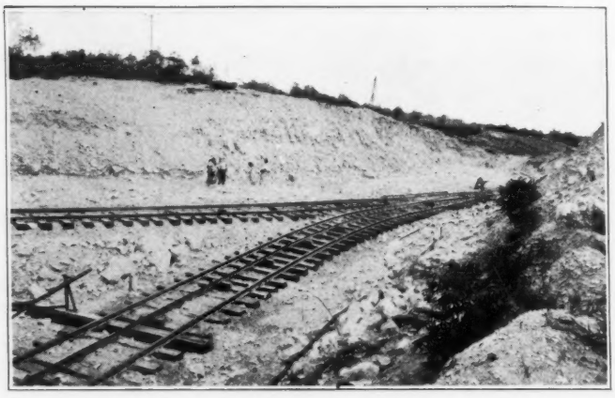
Blending

This plant has a layout that enables the blending of the raw mix before going to the kiln, as easily and as thoroughly as it is done in the wet process. This is known as the Fuller-Kinyon system of dry blending.

Each composition silo tank is divided into four compartments, thus affording 16 blending or composition compartments. After they have been

Corner in machine shop, storeroom at back

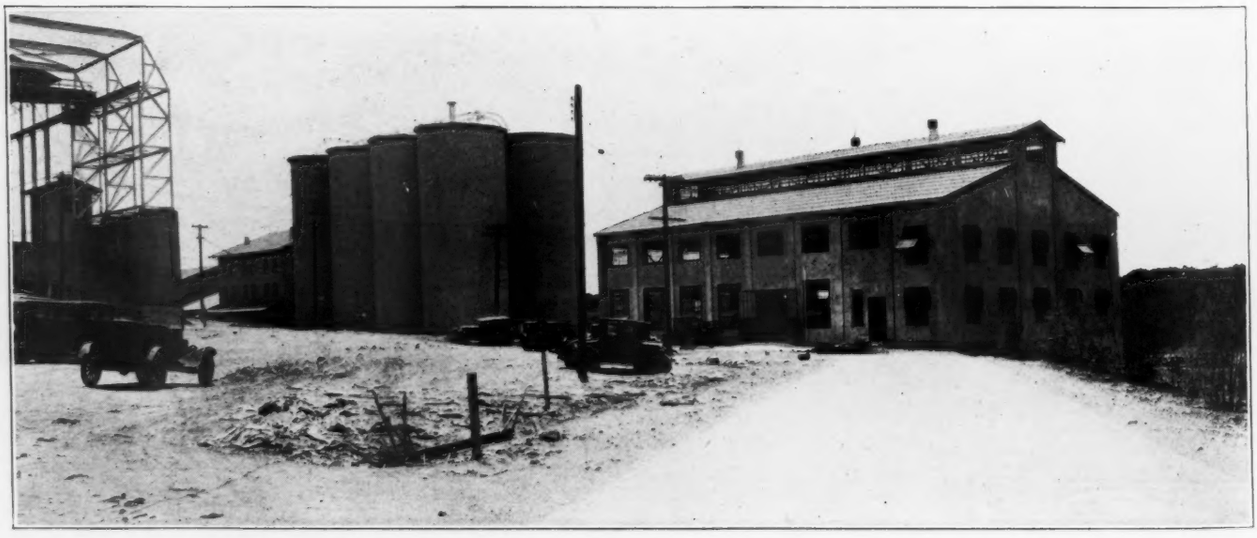
analyzed each compartment can be drawn off separately, or all of them at one time, or in any combination required to give the desired mix. The



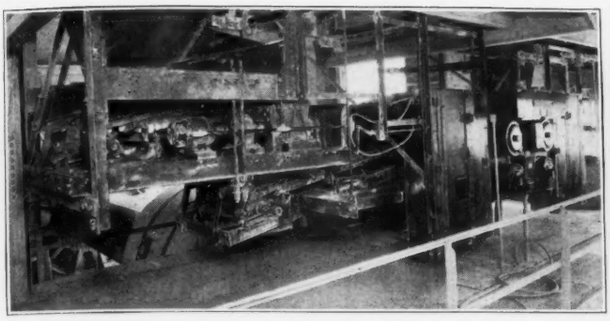
Quarry tracks with third rail for haulage system

various compartments can be drawn or filled at any desired time interval.

Blending this dry raw material is accomplished by a time-control device which automatically operates the switching valves in sequence. The silo composition bins are in line, and beneath each bin is a Fuller-Kinyon pump. A control board in the mixing-tank house shows the arrangement of the system and the switching ar-



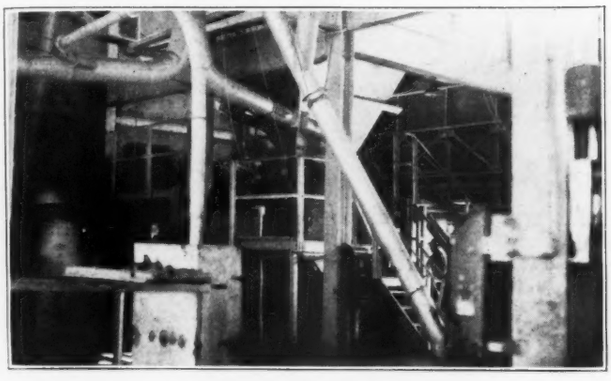
Road leading into plant, the building at right housing the office, storeroom and machine shop



Scales at the raw mill

rangement of the composition tanks. The timing is done at this control board.

In pumping the mix to the kiln-feed tank, from which it is fed into the kiln, other Fuller-Kinyon pumps are used. From the kiln-feed tank the mix is fed to the kiln by a screw conveyor which is driven by a 10-hp. motor through a Cleveland re-

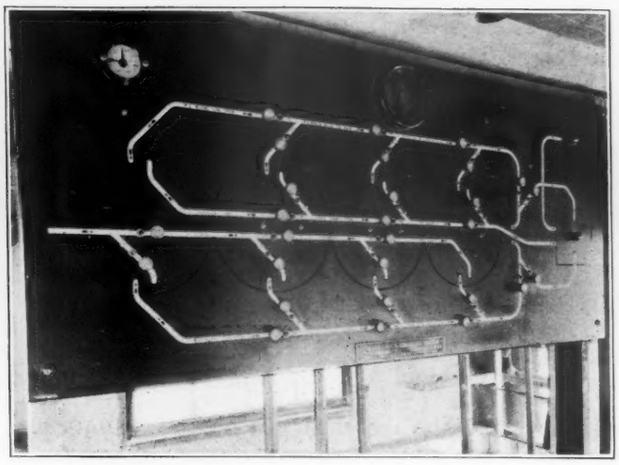


Portion of packing house

duction gear. The amount of feed to the kiln is controlled.

Burning

The kiln is elevated. It is an Allis-Chalmers rotary kiln 11 ft. by 250 ft. It is uncovered except for the motor driving the gear-driving mechanism and the firing end, and has four ring-bearings and one gear-drive of the Allis-Chalmers make. A 100-



Control board in the mixing-tank house

hp. General Electric motor drives the kiln through an Allis-Chalmers gear-reduction unit.

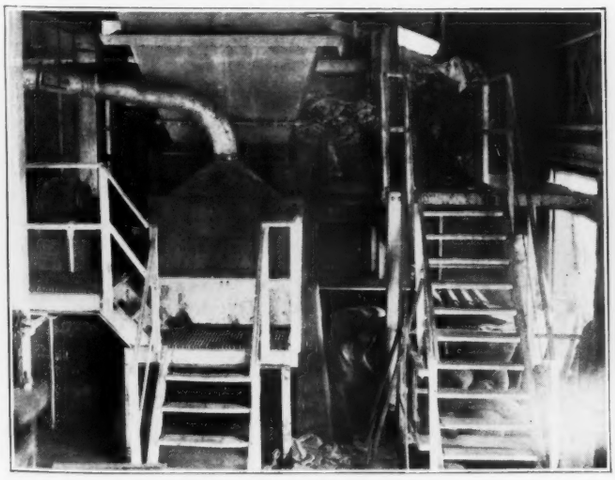
The kiln is fired with gas, using a Tate-Jones burner. A Sturtevant Company's fan draws hot air from the clinker cooler through a Clark dust collector to furnish hot air to the burner. Hot gases from the kiln pass through settling chambers before going to the stack, a portion of these gases being used in the dryers, as already stated.

Cooling

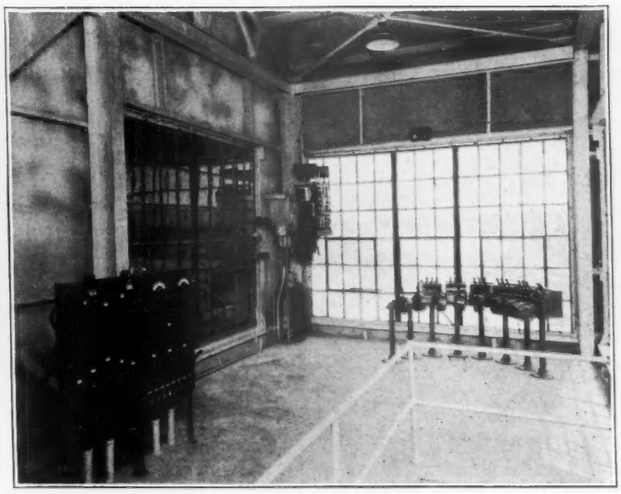
From the kiln the clinker drops through a vertical cooler to an Allis-Chalmers horizontal rotary cooler, 10-ft. by 142-ft., set at right angles to the kiln. It is driven by a General Electric 75-hp. motor through an Allis-Chalmers reducing gear unit. The clinkers discharging from the cooler are weighed by a single clinker scale of the Richardson Scale Company. From this scale the clinker is dumped into a clinker pit, whence a crane distributes it over the clinker storage.

Crane-Way and Clinker Storage

The crane-way extends the entire distance of the mill building, clinker storage, and cooler. The



One set of packers in packing house



Control room, electric haulage system

clinker storage is situated by the side of the mill building. The gypsum storage is a small part of the clinker storage.

The clinker and gypsum are handled by a 15-ton Cleveland crane with a 2½-yd. bucket which handles nothing else. The crane moves the clinker and gypsum to the hoppers of the grinding mills. From the hoppers, over the finish mill, the material is fed to Richardson scales that are similar to the ones used on the raw grinding mill. At the finish mill, as at the raw mill, an accurate mix is obtained.

Cement Storage

The cement storage silos are eight in number, each being 26 ft. in diameter by 60 ft. in height, and so constructed that there are three interstice bins.

Two portable Fuller-Kinyon pumps are located on tracks under the silos. Each pump takes care of four silos. These portable pumps transfer the cement to the bins above the packers in the packing house or they can transfer the contents from one silo to another. Any desired blending of the finished cement can be made in this manner.

Packing

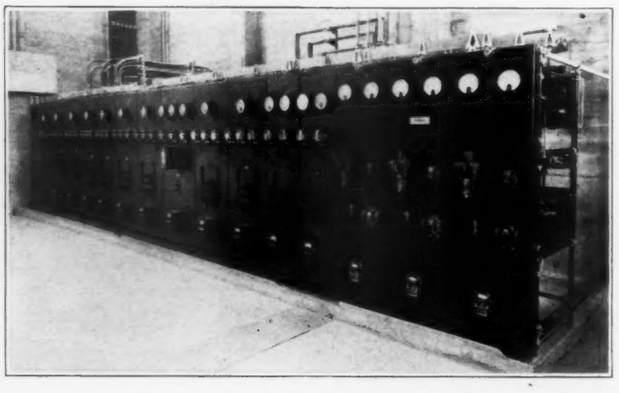
The packing house is a spacious building containing three Bates packers and a belt conveyor to the loading platform. Railroad cars are loaded from one side of the building and trucks from the opposite side. Two Bates packers load to the railroad cars, and one packer to the trucks.

In the packing house is located the control board of the Fuller-Kinyon system that operates in the finished cement storage silos and in the packing house.

Miscellaneous

Joining the mill room is the electric switchboard room which houses also the compressors and the motors that drive the Compeb mills.

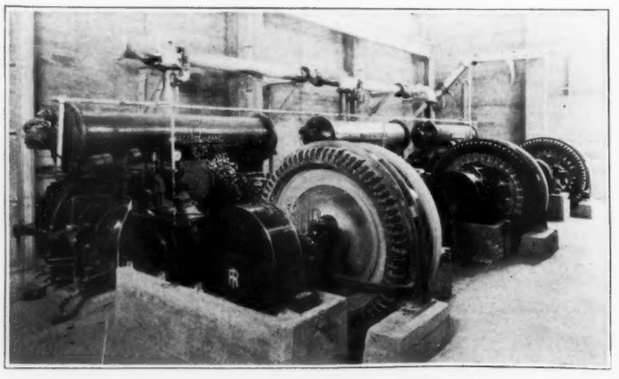
All units in the entire plant are driven by electrical motors, using a total of about 5,000 hp., part at 2,300 volts and part at 440 volts. The switchboard is 10 ft. in height and 35 ft. in length and is divided into 16 separate panels that control the entire plant. The company buys its electrical power.



Main switchboard in power house

There are three Ingersoll-Rand two-stage compression units, each driven by a 250-hp. Westinghouse synchronous motor to furnish the air for the entire plant including the Fuller-Kinyon pumps.

The machine shop, storeroom, office, and laboratories are housed in one building. The machine shop is well equipped with an Acme drill-press, two



Air compressors in mill building

Cincinnati lathes, one American Company's shaper, one Kearney & Trecker planer, an hydraulic press, and many other necessary machines.

A large storeroom is housed next to the shop, and a 10-ton Cleveland crane takes care of both the shop and the storeroom. The office is in one end of the building and is two stories high. The laboratory is in the basement. The accounting office is on the second floor, with the operating offices on the first floor. The building is fireproof throughout.

The whole aspect of the plant is pleasing to the eye. Its compactness is noticeable, and the efficiency of the layout of the whole plant indicates that best modern practice is followed advantageously.

The Atlas Portland Cement Company (of Texas) is owned by The Atlas Portland Cement Company with offices at 25 Broadway, New York, N. Y. This company is perhaps as well known as any cement company in the world, as it was the first to produce white portland cement commercially.

The Atlas Portland Cement Company has plants at Northampton, Pa.; Hannibal, Mo.; Leeds, Ala.; Hudson, N. Y.; and Independence, Kansas; and is contemplating the construction of a plant in Cuba. The Hudson plant and the Independence plant being operated by subsidiary companies.

Construction work and design of the plant was by the company's engineers. A. G. Croll, vice-president in charge of operations of all plants of the major company, supervised and directed both the design and construction.

Silica Forms the Bond of the Earth's Crust and Perpetuates Great Engineering Projects

[*This address, "The Romance of Silica," was delivered by E. F. Sargent, chairman, before the Yorkshire Branch of the Institution of Structural Engineers, Leeds, England. His researches and studies of silica are so comprehensive and so carefully presented that they are of much interest to our industries. He almost gives life to the grains of silica, without which the earth could not remain intact nor a structure of permanence be constructed.—Editor.*]

SILICA forms 60 per cent by weight of the earth's crust, and as the Great Architect of the Universe has chosen silica for the frame of this earth, so the structural engineer, in his infinitely humbler capacity, uses it to form about 60 to 70 per cent of the weight of concrete.

Silica touches the engineer from his pupilage to his retirement; it forms the glass of his office windows, through which he sighs for the liberty of the outside world; it is the chief ingredient of his lenses; it is used to give shape to most cast metals, to give certain properties to high-grade steels; it forms 20 per cent by weight of portland cement, 70 per cent of that of concrete, a very important part of the weight of bricks; reduced silica, or the element silicon, enters largely into the composition of that excellent abrasive, carborundum, which is next in hardness to the diamond.

In her deft art workshop, Nature has been able to turn it into the beautiful gem—opal—which the successful engineer can hang on the ears of his beloved.

Roughly, the earth weighs six thousand million billion tons; six followed by 21 naughts; figures too vast to convey meaning to any mind; its geological age is probably one hundred million years, again an incomprehensible figure, but a figure of some value as an aid to the understanding of the geological history of the earth, with which the origin of silica is intimately connected.

The shape of the earth is, as we all learn in our childhood, an oblate spheroid, two very mnemonic lilting words which cannot but live in memory throughout life; put into figures, they mean that the polar diameter is seven thousand eight hundred and ninety-nine miles, while the equatorial diameter is seven thousand nine hundred and twenty-five miles, a difference of only twenty-six miles; the latter is, however, a mean diameter only, since an equatorial section of the earth is not a perfect circle, any more than an equatorial section of an elderly gentleman of obese habit is a true circle, in spite of any impression to the contrary one may gather from the popular portraits of Mr. Pickwick.

The mean density of the earth is, roughly, 5.5, which on the above dimensions gives its weight as six thousand million billion tons, as already stated, while that of the sea is one five-thousandth, and that of the circumambient atmosphere one millionth of this.

Unfortunately for one's ideas of security, one finds that the mean depth of the oceans is some twelve thousand feet, while the mean height of the land surface above sea level is only two thousand three hundred feet; very careful observations made on the amount of silt brought down by the Mississippi show that the land surface of that basin is being denuded at the rate of one foot in six thousand years, and as this material is being poured into the ocean it follows that as the general surface of the land is lowered that of the oceans is raised, so that in about ten million years, if nothing else happens, the whole land surface of the earth will be awash with the seas. Although this epoch may offer a grand scope to the concrete man of those days to produce an impervious, uncracking envelope for the earth to prevent further denudation, we need hardly concern ourselves with this problem, since man, in his very earliest brute-like shape, has only appeared on this planet for the last one hundred thousand years, and, considering his progress in the mastery of the physical forces of Nature during the last hundred years, it is idle to speculate on his abilities in the next thousand years, and much less so on those of the next million years.

Expressed in millions of square miles, the total surface of the globe is one hundred and ninety-five, while that of the oceans is one hundred and forty, so that the waters cover nearly three-quarters of the globe, their volume being about 13 times that of the dry land above sea level.

It is this enormous volume of water that is a principal agent in effecting the changes that have taken place on the earth.

Geologists have found it convenient to divide geological history into five epochs, which they have named after the rocks which they consider typical of each period. These are the pre-Cambrian, named because its characteristic rocks occur in certain parts of Wales; no traces of life can be discovered in any rocks of this period; then follow the Palæozoic, or "old life" period; the Mesozoic, or "middle life"; the Cenozoic, or "new life" period, and lastly, the group containing the glacial, prehistoric and recent periods.

Silica Remains Unchanged

Our friend, silica, has endured unchanged through all these, and the very grain of sand you pick up by the roadside can laugh at your puny mortality and say, "A hundred million years ago I was a glittering quartz crystal in a mass of granite." Granite consists of quartz, felspar and mica; the felspar and mica have been washed away into impalpable clay, but the quartz crystal remains with its original molecules still in the same juxtaposition, and still the same entity, as when the earth ceased to be a boiling magma and the original granite first took shape.

Is it any wonder then that we can rely on the almost inconceivable resistance of silica to change to give changelessness in those structures which we fondly hope will perpetuate our work?

As already stated, the mean depth of the oceans is twelve thousand feet, while the mean height of the land above the waters is only two thousand three hundred feet; further, the relative positions of land and water have always been changing throughout geological times, the land having been submerged and re-elevated time after time; the original granite rocks, which reared their stubborn heads above the fresh water primeval seas, were attacked by frosts and scorched by suns, shedding their splinters to the foaming rivers, where, battered and pounded, bitten by the acids dissolved in the waters, their other constituents were dissolved or dispersed; but the quartz continued on its way, to be laid down on the sea floor as great layers of sand, to a depth of at least ten thousand feet; by the help of dissolved iron, silica, etc., these grains have been again cemented into rock, but differing entirely from the original granite, in that all the weaker minerals are now absent, and on subsequent elevation we have the earliest group of sedimentary rock, namely, the Torridon sandstones, examples of which can be found west of the counties of Sutherland and Ross, in Scotland.

But the troubles of our brave little friend, the crystal of silica, do not end here. As the parent rock emerges from the depths, wave action loosens the hold of brother on brother; later on, as the waters recede, atmospheric forces complete the work of dis-union, and once more separate grains are sent traveling over the face of the globe. Now the winds try their fell hands, and our poor little friends are sent trundling across the deserts of Sahara or the wastes of Arabia. This time his lot is far more arduous than when he was lapped beneath the waters, for he is now in perpetual conflict with his own kind, with the result common to such conflict, namely, that he has all his corners knocked off. He becomes rounded and easy to live with. He is still the same crystal as existed in the granite, but reduced in size, rounded, no longer so proudly glittering, but still willing to be of service to man where durability is required.

It must not be supposed that the fate of every disintegrated quartz crystal is so hard as that of the poor fellow we have just traced. Sometimes they come to rest in the bottom of a kindly ocean, not long, geologically speaking, after their original separation from their parent granite. Such would appear to be the case with the famous sands of Leighton Buzzard, so dear to the heart of the cement tester. These sands belong to the middle division of our scale of geological time, namely, the Mesozoic, so that if each division could be thought to occupy an equal time space, which most unquestionably they cannot do, the deposition of these Leighton Buzzard sands would have taken place fifty million years ago.

I have discussed the formation of sandstones from the breaking down of the original igneous rocks, and illustrated it by the formation of the oldest sandstone, namely, the Torridon, as having occurred about the beginning of geological time. As a matter of fact, this breaking down of granites and of all other rocks has been and is going on continuously right up to the present, and it is the formation of new rock which gives us the opportunity of learning something about the history of this planet. The pre-Cambrian rocks are destitute of any signs of life, with the exception of some very obscure organisms, whose nature it is difficult to ascertain. However, this period is sometimes named the Eozoic, or dawn of life, and from hence right up to present times life becomes ever more bundant and more highly organized. Of the first appearance of life on this planet we know nothing. Whether plants or animals came first, and in what form they came, are questions to which no satisfactory answer can be given, since these early forms would be minute, soft, and easily destroyed, and even if preserved in stone, the enormous vicissitudes to which these rocks must have been exposed would have crushed any organic remains out of all recognition; but with the beginning of the Palæozoic period, life was well established. The duration of this period must have been enormous, since in the British Isles alone the older half of these rocks is at least 16,000 feet thick and occupies an area of some 60,000 square miles, a mass of material which would make a mountain chain 1,800 miles long, with an average elevation of 16,000 feet; and all this was derived from the degradation of our pre-Cambrian rocks and the liberation of our friend the silica crystals.

Beginning of Life

Right early in these Palæozoic times appears an organism which plays a great part in the life history of silica; and this leads me to admit a blot on

his scutcheon which I would have much liked to conceal. Silica is slightly soluble in water, and the organism to which I have just referred is the sponge, which first makes its appearance as a living thing early in this epoch. To suck up water like a sponge is proverbial, but before it can suck up water it has first to suck up material which it can solidify into the domestic article as we know it. Sponges have chosen one of three materials for forming their exterior skeletons, namely, calcareous, siliceous, and horny. It is the horny skeleton which forms the domestic sponge, and with him, therefore, we have nothing further to do, although I should have preferred if I could have added this utility to the many I am claiming for silica. If, however, we, as engineers, owe a debt to silica, a part of that debt is due to the great race of sponges, which, with an intelligence I should not have given them credit for, have rescued, to the use of man, the silica which had allowed itself to get dissolved in water. Gratitude is a becoming quality in man, but how many of my engineering confreres recognize, as they enjoy their daily ablutions, that a distant cousin of their useful sponge has reclaimed from useless dispersal the silica which forms 80 per cent of the concrete structure to which they have given so much thought?

Insolubility of Silica

The amount of silica in solution in the oceans is 14 parts per million parts of sea water. This may sound a formidable quantity when one recollects the 1.4 million billion tons of water in the oceans; and, in fact, it amounts to 19.6 billion tons of silica apparently lost to the engineer. The discovery of this fact depressed me in my admiration for the durability of my little friend, but my equanimity was restored when I calculated the amount of my material left on the dry land, for I found that, although these figures may seem depressing to the economically minded, yet they only represent one-nine-thousandth part of the silica existing above water level. So there is really no need for me to conceal this slight aberation of silica from the paths of stern virtue. After the fierce handling to which the quartz crystals have been subjected, in some cases for one hundred million years, only one-nine-thousandth part has been dissolved by the all-conquering water. Is not this the last word in durability? Compare this with the resistance or durability of gold. Gold and silver both exist dissolved in sea water, and it has been calculated that the amount of the former is one part in fifteen million parts of sea water, so that the total weight of dissolved silica is 210 times that of the dissolved gold. As the amount of gold in the earth, measured by their relative prices, is only one-seventy-sixth thousandth that of silica, these figures show that gold is roughly three hundred and sixty-five times more soluble in water than silica, which again brings out the unconquerable durability of silica. The figures are also interesting from an entirely different point of view, as they bring out the astonishing fact that no less than ninety thousand million tons of the much desired metal, gold, await recovery at any man's hand in the boundless seas, a figure which is beyond the dreams of avarice.

Describing Uses of Sponges

But we must return to the sponges, which, as I have said, made their first appearance nearly with the first dawn of life on this planet. Sponges are animals, not plants, and they form a very striking, and very isolated, subdivision of the animal kingdom, having an immense number of species. They are all aquatic, and mostly marine, although some freshwater species exist. They vary in size, from minute microscopic individuals to great masses several feet in circumference, and they vary in shape, from amorphous masses to figures of the most perfect and exquisite symmetry. Their entire body is permeated by a system of canals for the circulation of water. These canals commence in minute pores scattered over the surface of the body, and coalesce, in their passage through the body, till they end usually at the upper surface in one or more large vents, which can be closed at will. The canals themselves are lined with a number of protoplasmic hairs, which keep up a constant whip-like motion, by means of which the water is driven along, issuing in a gentle, but readily perceptible stream at the vents. The body of the sponge, between the canals, is formed of a gelatinous substance, carrying the protoplasmic and connective cells, together with certain special cells whose function it is to select from the sea water the mineral matter, either silica or carbonate of lime, which is built up into the protective skeleton. In those sponges which are independent of mineral matter to form their skeleton, these special cells secrete a horny substance, called spongin, which forms the familiar domestic sponge, after the gelatinous matter has been removed.

As students of silica, we are only interested in the sponges which abstract silica from sea water. This silica is deposited by the sponge in small, elongated needles round a thread of living matter, and it is the interlacing of these needles which forms the spongy texture. To give cohesion, some of the needles are cylindrical, some of stellate, and some are hooked like an anchor. A chemical change has occurred in the silica in its passage through the body of the sponge, and it now exists in the form of silicic acid, which is also the form it exists in the opal, to which I have already referred. The curious may also note that the rasping teeth of certain snails are also formed of this silicic acid,

and they may, like Hamlet, moralize over the sad fact that the lovely gem in my lady's ear was yesterday the rasping tooth of a disagreeable snail.

This silicic acid dissolves readily in caustic alkalis, while silica does not, and it is, doubtless, to this solubility of the silica, as secreted by the sponge, that we owe the recovery, to the use of man, of that small proportion of silica which has been dissolved by water and exists in solution in the sea.

And this brings me to the second form in which silica is of interest to the concrete engineer, namely, flint. We can all recognize the difference between flint and quartz. Flint is usually a dark, amorphous substance, while quartz is clearly crystalline. Quartz has a specific gravity of 2.65, flint of 2.59, and opal of 2.2.

Flint Is a Form of Silica

Enormous beds of flints are found in the Thames basin, forming the principal source of aggregates for concrete for the London district, and probably something like two million tons per annum are excavated to supply the wants of, perhaps, ten millions of people. This flint gravel exists as pit gravel and as river gravel, but there is the clearest indication that all the gravels of this area originally formed the bed of a very much bigger Thames than that we know today, since they exist to the height of, perhaps, one hundred feet above the present river. If we proceed northward from the Thames Valley, till we arrive at the Chiltern Hills, we come upon the chalk and we find that vast quantities of flint crowd the surface of the fields. If we examine the chalk face as exposed in a quarry or railway cutting, we see flints closely packed in layers, which change abruptly into chalk. We also find massive sheets of flint, as well as scattered flints. Sometimes we find sheets of flint in vertical or inclined veins, but however far we press our researches, we can but come to one conclusion, namely, that the source of all flint is the chalk, and that it is by its denudation that the beds and sheets of flint which we have seen to be distributed throughout its thickness are exposed and finally find themselves in the river bed.

The origin of these flints in the chalk has always given rise to much speculation, and it is doubtful if the matter is yet finally settled.

Chalk Formations

Chalk consists of the remains of vast numbers of very minute animals which during life had the power of covering themselves with calcareous shell. Chalk is of remarkable purity, and was undoubtedly laid down in the clear waters of a very deep sea. It belongs to the Cretaceous epoch of geological time—which epoch occurs at the end of the Masozoic age, and if the time estimates of geologists, expressed in years, are at all reliable, this period dates back four to five million years. At that time the Mesozoic sea stretched right across the middle of what is now the British Isles from, say, the South Downs up into Yorkshire, and eastwards right across the North Sea into the heart of Europe. Its depth is probably comparable to that of the Atlantic today, or, say, 12,000 feet. There for millions of years the little animalculæ formed their calcareous skeletons, lived and died, their hard parts slowly sinking through the darkness of the great depths, to settle down as soft calcareous ooze at the bottom. In course of time there occurred one of these frequent alterations in the surface of the globe, and the sea bottom was slowly upraised, carrying with it these thousands of feet of ooze, clear above the level of the sea.

The same process of chalk formation is going on today at the bottom of the Atlantic, and the nature of this ooze was first investigated by the Government ship *Challenger*, which, sailing in December, 1872, did not return till May, 1876. The contributions to science she brought back were marvelous, and are contained in some fifty volumes, the last of which did not appear till twenty years after the expedition returned. It is somewhat significant that no flints were found at the bottom of the oceans, although, in every other respect, the ooze was found to be strictly comparable to the solid chalk. We have seen how the sponges abstract the silica from water and build it up into the framework which supports and defends their frail bodies, and we have seen that this silica is no longer the hard, insoluble silica of the granite rocks, but a much more easily soluble form, and we can readily believe that, as the sponges died and were covered up by increasing thicknesses of ooze, this silica would be dissolved out, and would remain in solution in the slowly drying chalk. That this is a fact is proved by examination of the chalk. It is found to contain cavities which correspond in shape to the spicules which, as already mentioned, form the framework of the sponges as we know them today. This seems pretty clear evidence that these sponges decayed and their needles were scattered on the sea floor and slowly covered up with ooze. These cavities form 3 per cent of the volume of chalk, so that it is safe to assume that there is at least that amount of silica distributed through the chalk.

This silica ought to be distributed uniformly throughout the chalk, which would leave some difficulty in accounting for the fact that flints occur in definite bands throughout its depth, and the problem of these definite bands becomes a most interesting one, which, however, is rather outside the scope of my address tonight, but it may be said that the bands apparently occur with a rhythmic frequency which bears a striking resemblance

to the rhythmic precipitation of certain salts in a collodial medium, the idea being that during the uplift of the chalk the silica solution drained slowly down and either attained sufficient concentration, or met with a precipitant, causing deposition of solid silica in sheets, in closely packed nodules, and in scattered nodules according to a periodic law. However this may be, we again find our friend silica snatched from solution in a watery grave, and comfortably tucked up as solid amorphous lumps in the depths of the chalk, to be again exposed and returned to the service of man when the chalk is denuded and the flints become a river bed.

In the course of this brief review we have gained some faint idea of the almost infinite resistance of the silica crystal to degradation, whether caused by mechanical wear or by the more insidious attacks of solvents. We have also seen that, where he is worsted in the strenuous strife, two good friends come to his rescue—the sponges and chalk—and give him a new body, not perhaps so brilliant as his early one, but sufficiently so for this workaday world.

If I might be allowed to return to those interesting animals—the sponges—for a moment, I would like to remark that there are about 14 grams of silica in an average small sponge which has taken five years to grow. This amount of silica has been abstracted from about one ton of water, and it is confirmed by direct measurements of the velocity of the water currents issuing from the vents of sponges, that far more than this quantity of water would pass through the sponge in this time. We have also seen that the sponge can abstract carbonate of lime if it wants to, or it can manufacture its own horny material. What a pity it is that the intelligent sponge did not turn its affections to gold, which exists in sea water to the extent of one-two-hundredth of that of silica, and form its frame of this precious metal. Fancy the thrill of cultivating a bed of sponges, each of which would produce half an ounce of pure gold in five years! Attempts have been made to recover gold from sea water, but if any success is to attend these efforts, it will probably come from the aid of finely divided material in the gel form, presenting an enormous surface where surface tension can act. Silica itself forms one of the most stable of gels, as I shall presently show.

First Lethal Weapons

If quartz and flint are of enormous use to the present day engineer, it is probably due to the latter, namely, flint, that man evolved from the brute stage at all. Palæolithic man discovered that he could make a lethal weapon from flint, and probably also that, by hitting a piece of flint on marcasite—a sulphide of iron occurring in association with flint—he could produce a spark, which he subsequently learned to conserve and increase by receiving it on dry moss. The possession of these two—the weapon and the fire—marked the beginning of that stupendous march which draws us ever farther and farther from the brute, and both are due to silica. Further, our whole knowledge of early man is gained from the preservation in the Quaternary gravel of his flint weapons; again a triumph of the indestructibility of our friend.

Incidentally, flint weapons are partly the cause of my recent investigations into silica, and are thus responsible for the address with which I am occupying your attention tonight; for I was struck by the fact that London pit gravels are much more serviceable for crushing to form aggregate than river gravels. As I knew they both came from the chalk, I spent some time in the London Geological Museum to see if there was any record of investigations into the physical properties of flint. Nothing had apparently been done in this line, but I learned an interesting fact, namely, that Neolithic man knew that different beds of flint in the same chalk were differently serviceable to him as weapons. Neolithic sinkings have been discovered down into the chalk, which passed through some beds of flint to reach another at lower depth, where a horizontal shaft was driven and the flints brought to the surface. Actually, the roof of one of these adits had fallen in and crushed the poor little Neolithic man at work. Thus he had discovered, ages before our time, that the physical qualities of flint vary, and he lost his life in taking advantage of his knowledge. Again, we all know that until recently flint balls were used in cement grinding—another service of silica to the engineer which I have not hitherto mentioned. The flints to form these balls are found on certain coasts of Iceland, Denmark and near Dieppe. The balls, as used, range in size between 2 inches and 3 inches, and my friend, Mr. Gibson, director of Earles Cement Works, tells me that the Iceland product is superior. Photographs of the Danish coast show these flints in situ, in fairly thick beds on the cliff face. As the cliff weathers they fall to the beach, where the rolling action of the waves reduces them to spherical shape. Flints above or below those do not become spherical, and are useless for cement grinding. Our obliging friend, silica, has not yielded up the secret of this physical difference, and perhaps, regarding it as idle curiosity on my part, it is another of his virtues to keep silence.

It is not surprising that substance so inert, so unchangeable as silica, has been fastened on by the chemist in his search for a finely porous body, since if there were any surface deterioration the pores would soon be filled. Minute capillary tubes act as catalytic agents, namely, they can set up, and intensify, chemical action between two different mol-

ecules which are chemically capable of combining. Thus, spongy platinum, when impinged on by hydrogen, brings the molecules of hydrogen and of the oxygen in the air into such close contact that combination of some of the molecules takes place, causing local heating, which intensifies the action until finally the temperature of ignition is reached, when combustion takes place. The platinum remains unaltered and can be used to ignite hydrogen over and over again.

Silica Replaces Platinum

I am, unfortunately, unable to give you any comparative figures as to the durability of platinum and silica, but silica is at present being used in the same way (although not to cause ignition) as spongy platinum. To prepare this spongy silica, solutions of sodium silicate and sulphuric acid are mixed together in proper proportions and in a predetermined manner, resulting after several hours in the production of a jelly-like mass, called hydrogel. This is broken into convenient sized lumps, washed to free it from sodium sulphate and excess acid, and dried. It is now the silicagel of commerce. Its internal structure is probably a collection of minute spheres of perfectly pure silica, with their attendant spandril spaces, the latter amounting to about 41 per cent of the total bulk. Naturally, the total surface area of these minute spheres is of a very big order of magnitude as compared with their total volume, and I understand the owners of the process claim that in one gram of the substance there are no less than five thousand square feet of internal surface. I have in my hand half an ounce of this substance. In that little half-ounce there are internal surfaces which equal in area the floor space in a room 70 feet by 70 feet. This product is marketed by the Silica Gel Corporation, which claims that it can so regulate the size of the grains in the mass as to cause it to be suitable for a large variety of uses. As there are 40 per cent of spaces in the gel, so it follows that it will instantly absorb 40 per cent of its volume of water, which can be driven off again by the application of heat. As the surfaces are capillary, the water is instantly absorbed. The melting point of silica is very high indeed, and it can only be volatilized in the electric arc; thus it is eminently a substance which can be heated and reheated endlessly without undergoing change.

Uses of Silica Gel

An interesting application of this gel is the separation of the constituents of a liquid or gaseous mixture. The fine capillary spaces of the gel, with their attendant film of moisture, attract and hold those molecules in a mixture which has the least surface tension, allowing those with greater surface tension to pass through. In time the gel becomes saturated with the retained molecules. It is then re-activated by the application of heat, and can be used over and over again. An important application of this process is in the refining of mineral oils, which are now so important industrially. It so happens that the sulphur compounds of oils have less surface tension than the non-sulphur compounds. Therefore, silica gel affords a very ready means of removing these sulphur compounds. As a drying agent, silica gel has unique properties, owing to capillary attraction. If a gas, holding the minutest quantities of vapor in suspension, is passed through the gel, the vapor is retained and condensed while the gas passes on. In the States, where there are such large supplies of natural gas, it is found that, mixed with these gases, there is a certain proportion of petrol vapor. By simply passing these gases through the gel all the petrol is retained, and can be recovered in an unmixed state by the application of heat.

It follows that air passed through gel is immediately dried at a very small cost, seeing that the gel can be re-activated by the application of heat. This process has been applied to blast furnaces in order to secure perfect uniformity in the humidity of the blast. Air holds water vapor in suspension in amounts which may vary between three grains and five grains per cubic foot, and as the amount of blast required is of the order of forty thousand cubic feet per minute, it follows that an amount of water vapor varying from one thousand pounds to eighteen hundred pounds per hour are pumped into the furnaces. The effect of this is to introduce a further variable into a reaction where there are already too many variables. The apparatus is extremely simple. Large sheet-iron chambers are built having a number of inclined trays, perforated at their bottoms and carrying the gel to the depth of some inches. These trays divide the chamber into two compartments, so that the blast has to pass through the layers of gel, parting with its moisture in its passage. A number of these chambers are placed in parallel, and when one of them has absorbed all the moisture it can take, it is cut out by suitable valves, and hot air is passed through, which, in the course of an hour or so, completely re-activates the gel.

It may be readily guessed that this new form of silica finds many applications in the arts and manufactures. For instance, in the now important technique of gases compressed in cylinders, slight traces of oil are carried from the compressors as vapor, which is very undesirable. The simple passage of the compressed gas through gel removes these vapors.

If the vapor absorbed by the gel is from a liquid which boils at a fairly low temperature, a refrigerating plant can be constructed which operates continuously without mechanical appliances; thus, if you connect a cylinder of liquid anhydrous ammo-

(*Continued on page* 50)

Mining and Treatment of Gypsum at South Australian Plant

AT THE town of Thevenard in South Australia, the Waratah Gypsum Co. Pty., Ltd., operates a thoroughly modern gypsum grinding and calcining plant that produces around 850 tons of plaster weelky, representing the output of three kettles. The raw material is obtained at Lake McDonnell, and is transported to the mill first by an aerial tramway five miles long, and then by a railroad journey of 59 miles.

The operation of this interesting plant was recently described by L. J. Winton, B.E., Chief Inspector of Mines for the South Australia Department of Mines, in an article in the mines department's "Mining Review," and later in *Chemical Engineering and Mining Review*, published at Melbourne, and the following notes on this operation are summarized from these publications.

The gypsum at Lake McDonnell forms a very large surface deposit lying to the north and east of the lake and covering an area of about 27 square miles, comparatively level. The mineral occurrence is mainly in the form of "seed gypsum," apparently about the same thing as the gypsite or gypsum earth in our southwestern states, and because of its loose pulverulent form can be excavated at a quite low cost. The purity ranges from 84.4 per cent to 98.4 per cent. The average depth of first quality gypsum is about 2 ft., and the estimated amount of this material is 68,000,000 tons, in addition to which there is believed to be an equally large tonnage of gypsum somewhat discolored by organic matter. In some parts of the area an inch or two of somewhat dirty gypsum has to be removed first; in other parts this is not necessary.

Method of Quarrying

For excavating the gypsum earth, Fordson tractors, equipped with a special loading device, are used. This device consists of a large scoop carried on the front of the tractor, which can be lowered, raised, and tipped by the tractor operator. In operation, the scoop is lowered and the machine driven forward over the deposit till it is filled. The driver then raises the scoop and drives the tractor to a row of small railway cars and tips the scoopful into a car, repeating the operation until the cars are filled.

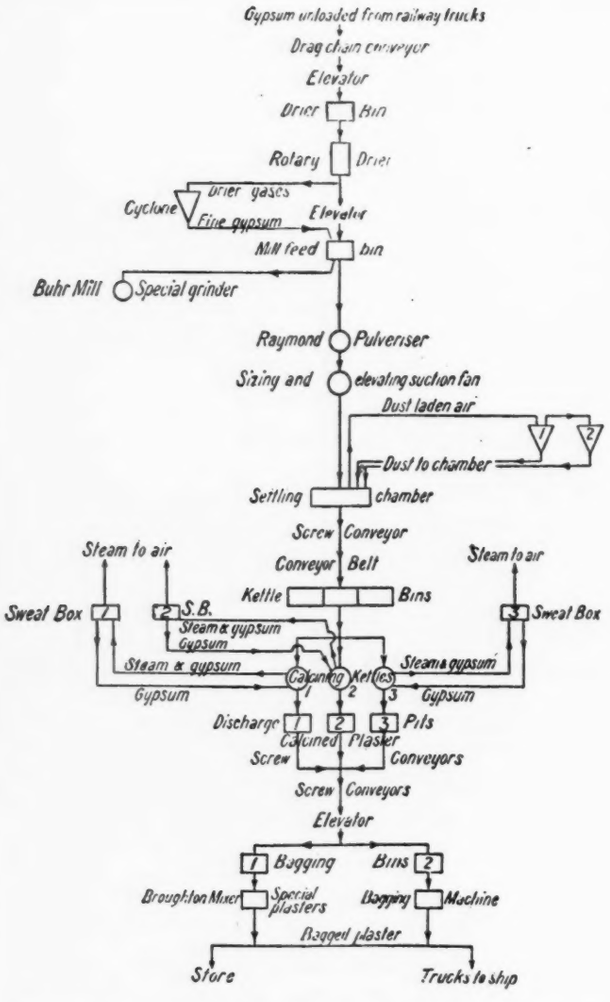
Tracks for the cars are laid out conveniently over the area to be worked, and the trains of side-dumping cars are hauled over these tracks by Fordson locomotive. The cars when filled are hauled in to the loading terminal of the aerial tramway, where the gypsum is dumped into the boot of an elevator that lifts it to a loading bin of 150 tons capacity, from which the aerial ropeway is fed.

The aerial tramway is of the monocable type, using only one rope which travels in an endless circuit, passing over large horizontal sheaves at each end and carried by sets of vertical sheaves on the supporting towers. It is five miles in length —probably the longest in Australia—and goes in a direct line from the loading bins at the gypsum deposit to storage bins at the Kowulka railway station, where the company has a siding for loading railroad cars for the 59-mile haul to Thevenard. The tramway passes over undulating country, and the 66 towers carrying the tramway vary in height from 20 to 62 ft. The towers are set on solid concrete foundations.

At the loading terminal at the gypsum deposit, the traveling rope connects with a fixed iron shunt rail passing around the loading bins, and incoming empty buckets move off the rope onto the rail. They are then pushed around the end of the bin by hand, filled with about 1,200 lb. of gypsum, and then pushed on to the end of the rail and thence picked up by the ropeway. The attachment of the buckets to the rope is said to be very simple and effective, the bucket being hung from a semi-circular piece, a few inches long, which merely sits on the upper half of the rope circumference without being fastened to it in any way. In the hollow of the piece there are two slight projections, one at each end on opposite sides, and these give the grip required to prevent the bucket slipping on the rope. The hanger of the bucket is provided with small trolley wheels which pick up the fixed iron rails at the bins.

The tramway cable is of 1-in. diameter, and travels at approximately 5 m.p.h., each bucket therefore taking an hour to make the trip. The full capacity of the line is 65 tons per hour, but at present about 147 buckets are usually carried on the rope, with an average load of 1200 lb. of gypsum per bucket. The ropeway is driven by a 130-hp. semi-diesel engine at the Kowulka end, and communication with the loading terminal is maintained by telephone.

At the Kowulka terminal, the buckets pass over a 200-ton storage bin, and here in the same manner as at the loading terminal the buckets pass off the rope onto a fixed iron shunt rail, and are pushed round by hand, dumped where required, and sent off the end of the rail onto the rope again for the return trip. The gypsum is loaded



Flow sheet of plaster manufacture, Waratah Gypsum Co. Pty., Ltd., Thevenard, South Australia

from the storage bins into railroad cars and hauled to the calcining mill at Thevenard.

Grinding and Calcining Plant

There the railroad cars discharge one at a time into an unloading trough and thence the gypsum is carried by a chain drag conveyor, screw conveyor and elevator to a large rotary dryer. The dryer is 60 ft. long and 5 ft. in diameter, with angle irons for lifting the gypsum as it passes through. It is fired by a coke-burning furnace at the feed end, and at the discharge end a large fan draws the heated gases through the cylinder and out to a cyclone dust arrester which recovers any dust that the gases may have carried away. The dryer has a capacity of 10 to 12 tons an hour, depending on the amount of moisture the gypsum contains. The dried gypsum is then elevated to a storage bin above the pulverizing plant.

This plant originally consisted of a number of buhr-stone grinding mills, of which there were to be five, but later the plan was changed and most of the grinding is now done in a Raymond 5-roller mill, a buhr-stone being used occasionally for special work. The gypsum ground in the Raymond mill passes through a settling chamber and two cyclone dust arrestors, and is then taken to the three kettle feed bins by a screw conveyor.

Each of the three calcining kettles has a capacity of 4½ tons, and the calcining of a charge requires a little over an hour. Each kettle is set in brickwork over a coal-fire furnace and is fitted with a convex bottom to facilitate discharge. Four parallel flues pass through the kettles horizontally, carrying the heat through the charge of gypsum, and the content of each kettle is agitated by means of a revolving vertical shaft fitted with two sets of stirring arms and a bottom set of trailers, the shaft making about 15 r.p.m. The trailers serve also to discharge the plaster through the side discharge door of the kettle when the calcination is complete. Automatic temperature recorders are fitted to each kettle to enable close control of the temperature during calcination. The steam driven off in calcination passes out through a flue in the lid of the kettle and any entrained gypsum is removed in a "sweat box" above the kettle.

The calcined gypsum (plaster) is discharged into a pit in front of each kettle and fed by screw conveyors to an elevator which lifts it to storage bins. From these the plaster is fed to a double-feed automatic bagging machine, and the filled sacks are stored in a 1,500-ton warehouse. The sacks are then loaded into railway cars or onto a second aerial tramway connecting the mill with the jetty, by means of which either plaster or raw gypsum can be taken from the works and loaded directly to the hold of a vessel for water transportation to the various markets. This ropeway is of the bicable type and is about a half mile long, carried on structural steel towers, and has a capacity of 75 tons of gypsum, or 50 tons of bagged plaster, per hour.

For making special plasters with the addition of various ingredients, a large Broughton mixing machine, situated alongside the bagging machine, is in use. Any special grinding can be done in one of the buhr mills, in which two large millstones, set horizontally on a vertical spindle, are used. The faces of these stones are grooved radially, the depth and number of grooves being suited for the fineness required.

Power Service

The power plant includes a 300-hp. Garrett locomobile steam engine and boiler and a large Babcock & Wilcox boiler from which steam is obtained for a Browett-Lindley high-speed engine driving a 2300-volt 50-cycle 3-phase a.c. generator. Conversion of the whole plant to electric drive is being considered, power to be generated by a 750-hp.

(*Continued on page* 50)

European Practices in Excavation and Preparation of Sand and Gravel

Market Requirements Are Different in the Various Countries

By D. D. GUILFOIL

[PIT AND QUARRY *endeavors to keep its readers informed of foreign developments in the non-metallic mineral industries. We appreciate, therefore, this privilege of presenting the opinions of an American who has made a personal investigation of one special phase of these industries and who gives, in the following articles, numerous industrial and economic aspects of European customs and methods that differ not only from country to country but with our domestic practices.—Editor.*]

IN THE years 1928 and 1929, it has been the writer's privilege to spend a total of about five months traveling in many European countries. As these were business trips for my company, and as our buisness has always been closely allied to the sand and gravel, quarry, and cement industries, it naturally follows that more or less opportunity was afforded to make observations of these industries in these European countries. In order that this article may present all of these observations, I am combining both trips in my comments herein presented.

Viewing the sand-and-gravel industry of Europe as a whole, a man from this country will quickly recognize four things in the industry that are quite different from operations in the United States. These are:

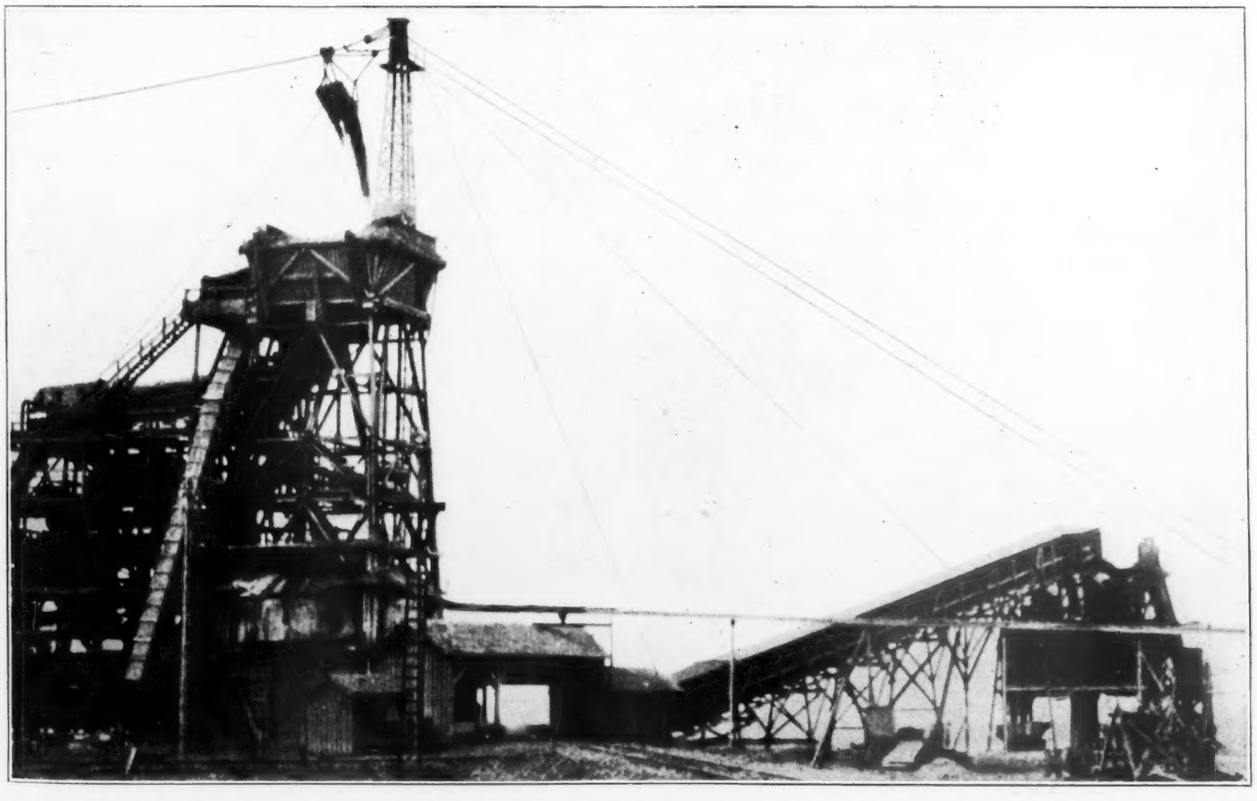
First: The large proportion of the material for concrete aggregate that is not washed. Sizing or screening is rather usual but washing is not.

Second: The large proportion of the material that is transported from pit to market by water haul instead of by rail haul.

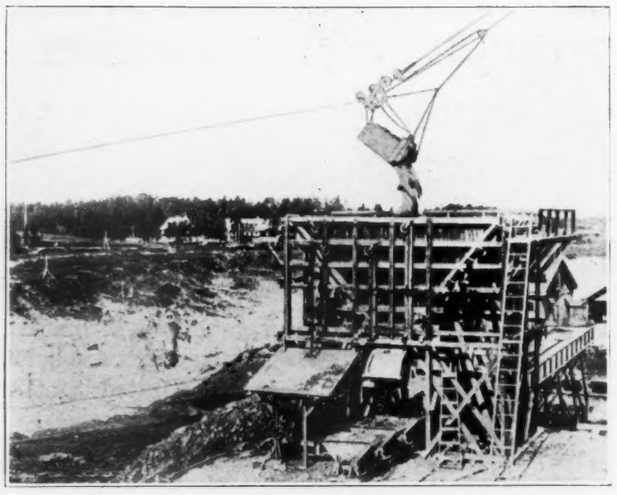
Third: The extensive use of aerial tramways (or ropeways, as they are more commonly termed in Europe). Where the marketable product is loaded on boats, tramways are used in the majority of cases for transporting from screening plant to boat. Frequently, where marketable material is loaded into railroad cars, tramways are also used to transport the material from screening plant to railroad, rather than, as usual in this country, building a side-track from railroad to screening plant.

Fourth: The large amount of labor compared with output. This applies even to pits that are well mechanized.

As these trips were made in the business interests of my company, Sauerman Bros., Inc., Chicago, it is only natural that I was more interested in the excavating problems of the various industries than in their other problems and, conse-



American slackline cableway and mast, excavating marl for one of Sweden's largest cement factories. Gravel that accompanies the marl is separated and sold to contractors



This cableway is dumping overburden from which clay is reclaimed and utilized as raw material for the famous Pargas cement

quently, obtained more information relative to these excavating problems than to the others.

In one way, the U. S. A. manufacturers of excavating machinery which is used in the sand-and-gravel industry, have some advantage in European markets over the U. S. A. manufacturers of other types of machinery used in the gravel industry. The reason for this is that, in certain countries and for certain jobs, pit-run material is quite salable. This leaves then merely the excavation problem, and thus it becomes necessary only for the excavating machinery manufacturer in this country to demonstrate the superiority of his type of excavating machinery over hand labor, or its superiority over excavating machinery of similar or dissimilar types manufactured either here or abroad. The manufacturer of washing and screening machinery, however, is eliminated from any prospective business under these circumstances.

Again—and these are the circumstances that exist in the majority of cases—the market conditions may call for a screened product but do not call for a washed product. So the manufacturer of screening machinery has a prospective market, but still the manufacturer of washing machinery does not have a prospective market. Of course, the material must be excavated, so the excavating machinery manufacturer still has his prospective market under these conditions.

While my observations showed me a great deal of U. S. A.-manufactured excavating machinery in gravel plants throughout Europe, I did not see a similar proportion of U. S. A.-manufactured screening and washing machinery.

There are many European manufacturers who make good excavating machinery, but they have not paid particular attention to the demands of the sand-and-gravel industry, and are, to a great extent, offering rather an all-around excavating or earth-moving apparatus without trying to fit it especially for the sand-and-gravel industry.

The manufacture of screening machinery is rather an old industry in many European countries, and one sees much of such machinery in use in European sand and gravel pits. Here again, however, is evidence that the manufacturers are not particularly studying the needs of the sand-and-gravel industry; and where you do see American-made machinery of this classification you most generally see that it is quite superior, for the purpose, to the European-made equipment.

In England the sand and gravel operations more closely resemble those of the United States than do those of any other European country. In England the architects' and engineers' specifications are most generally such that material must not only be sized and screened but a large proportion

Partial view of Brimsdown pit. Excavation unit has a 600-ft. span

of it must be washed. Also, in that country, most of the output of the various plants is shipped by rail, so they have similar carloading problems to those that are encountered in this country. The English idea of a carloading plant is quite similar to that which exists in this country—namely, the building of a side-track from the railroad line to the washing and screening plant.

There seems to be a fair supply of sand and gravel throughout most of England, although the deposits do not run to as great a depth as are often found in this country. It is unusual in England to encounter a deposit of more than 25 ft. in depth, and I think I can safely say the average is closer to 18 or 20 ft.

There are in England many stone quarries turning out crushed-stone aggregate for concrete purposes; and, while there is considerable stone used in the metropolitan area of London, there are many fairly good gravel deposits adjacent to this area, so that the sand-and-gravel industry in England has some of its largest and most extensive plants in this metropolitan area.

The plant of the Brimsdown Sand & Ballast Company has been operated for some ten years on the outskirts of the city of London. An item of interest in connection with this plant is the fact that it was built in the early part of 1920, and is of all-steel construction. Very few plants built in the United States at that period were of this type of construction. Of course, timber is a scarce article in England, and always has been, while steel is always plentiful, and this probably accounts for the greater use of steel in connection with sand and gravel plant construction.

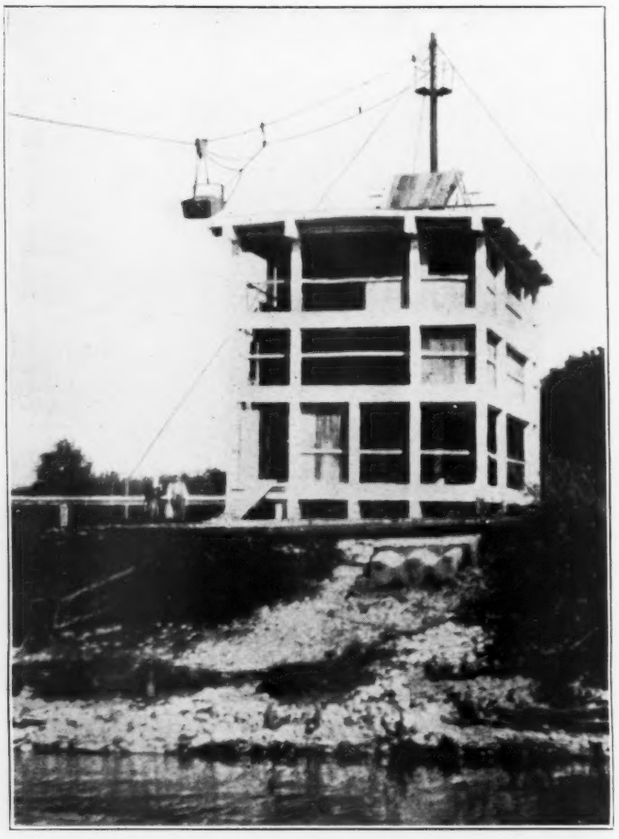
Limestone deposit of Pargas Kalksbergs, Finland, covered by thick layer of clay that is stripped by a slackline cableway

Lojo-Kalkverks, a leading Finnish maker of cement, uses a drag scraper to strip its limestone deposit

Conditions in France are similar to those in England. There are, in many sections of the country, fine deposits of sand and gravel, many of them running much deeper than the English deposits. The preparation of the material for the market, if that market is in some of the larger cities, is also quite similar to the preparation in the United States, inasmuch as a great proportion of the material must be washed as well as screened.

France has a considerable mileage of river and canal transportation and, on account of the low cost of water haul, the gravel pits are situated, wherever possible, so that a water haul to the best markets can be obtained. As this is not always possible, we still see in France a large proportion of the material transported by rail.

In Italy, the greatest activity in the sand-and-gravel industry is in the northern part of the country, and a large portion of this centers in the vicinity of Milan, which is the principal industrial city of this country. There are several modern plants in the vicinity of Milan, practically all of which wash and screen their output. Various



This neat Swiss plant, with its American equipment, produces 200 tons of gravel daily

types of excavating machinery are used, as no one type seems to be more particularly adaptable for the conditions than any other. The same is true of Switzerland, although the Swiss plants generally are smaller.

In the little country of Belgium, we find a rather unusual situation as regards European countries. There is not a great deal of sand and gravel in this small country, although there are some fair deposits in the vicinity of Brussels. The country uses a great deal of sand and gravel, and this makes necessary the importation of these materials from other countries. At the present time the greatest foreign source of supply is Germany. Practically all the sand and gravel imported into Belgium from Germany is brought into Belgium by water haul through rivers and canals. The bulk of this import comes on a canal which runs through Holland, and the Dutch Government levies a tax on the material that is transported through the country. This is such a problem that I found, this year, that the Belgians were considering the possibility of constructing a water-way from Germany into Belgium that would not pass through Dutch territory, if they were unsuccessful in their present negotiations with Holland either to have this tax removed or materially reduced.

Throughout Continental Europe, it will be found that the importation of sand and gravel from one country into another exists to rather a large degree, and this is a problem which the European producer must confront and which is not presented to the majority of producers in the United States.

The country of Holland uses a fair amount of sand and gravel, but the bulk of it is secured as a by-product of other necessary work. Holland is a country traversed by many canals, and it is necessary that these canals be regularly dredged and kept to a certain depth. In connection with this dredging a large amount of sand and gravel is removed from the bottom of the canals, and this in turn is placed upon the market, and is the principal and practically the only source of sand and gravel in Holland.

Germany produces quite a large quantity of sand and gravel, and the industry in that country presents a rather curious viewpoint. There is probably more sand and gravel produced in Germany by hand digging and primitive modes of conveyance, such as wheelbarrows, to the railroad cars or boats which take the material to the market, than in any other European country. At the same time, one will also find in Germany the largest pits in Europe, and the pits having the largest and most modern excavating and other types of machinery. German industry does not seem to care much for small machine units and, unless the plant operations are of sufficient size to justify the necessity of large machinery, there seems to be a tendency to handle the work by hand labor.

Of the northern countries, Sweden is the most advanced in its sand-and-gravel production and has the most pits. Sand and gravel are quite plentiful in Sweden and are found in small or large quantities in most every section of the country. The principal market is the larger cities, and practically all of these are located on the water. As a consequence, almost all of the Swedish plants are located so as to send the bulk of their product to market by water. It is at these plants and at the German plants that one sees the greatest development of the aerial tramways for the transportation of the material from the screening plant to the water or rail carriers.

In Sweden, it is the exception when you find a gravel plant where the material is washed. Practically all plants screen the material.

Modern machinery is used almost exclusively. The majority of pits use for excavating equipment either power shovels or power drag scrapers, as most generally the deposit is a bank deposit adjacent to a river or canal.

The power shovels that are used are almost all of either United States or German manufacture. The power drag scrapers used are, almost exclusively, of United States manufacture. One of these scrapers is used at a typical Swedish plant on the sea coast south of Stockholm. Most of these plants

are small in size compared to the average American plant, but they are very efficient, and well meet the demands of the market.

A rather interesting plant encountered in Sweden is that owned by the Klagshamms Cement Company at Klagshamms. The excavating unit is a 1½-cu. yd. Sauerman slackline cableway excavator, which was originally purchased and installed for the excavation of marl at the edge of the sea; this marl to be used in the manufacture of cement. The tail-tower or A-frame of the cableway is mounted on a semi-circular concrete wall which extends out into the sea from the shore. This makes it possible for the cableway to make a semi-circular excavation.

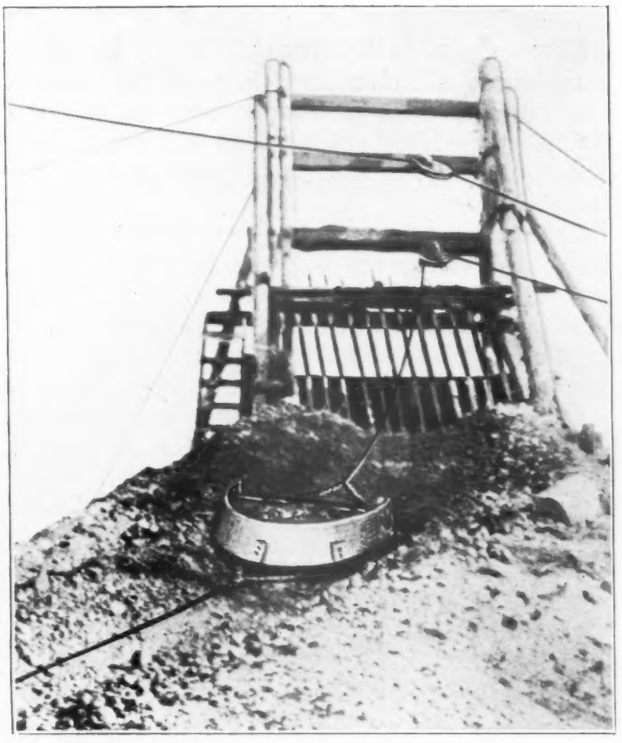
After this plant was installed and put in operation it was found that this marl contained a very large percentage of very fine gravel. The gravel, of course, was not needed in the cement operation —in fact, was a detriment—so the hopper structure had to be re-arranged to incorporate a scrubber and washing equipment that would separate the gravel from the marl. The gravel thus obtained was of such a quantity that the company quickly found they had a good by-product and actively entered the gravel business. When the writer was at this plant the company was supplying about 100 cubic meters of gravel per day to contractors and other purchasers located in that vicinity.

The Norwegian gravel plants of any size are situated near Oslo, which is the big central market for these materials in that country, the same as Stockholm is the big central market in Sweden, and most of the Swedish plants are located near Stockholm. These Norwegian deposits around Oslo are exactly the same as the Swedish deposits around Stockholm, being bank or hill deposits located adjacent to rivers or other bodies of water on which the product can be shipped by boat to the central market.

As in Sweden, most of these plants use power shovels or power scrapers for excavation, and aerial tramways are extensively used to take the material from the screening plants to the boats. There is no washing of the materials.

North of Oslo and on the west coast of the country there are other good deposits of sand and gravel, but the only market for this material is for road-building purposes. Most of the gravel taken out in this section is taken out by the road commissioners for their own use in the construction and maintenance of highways.

In Finland we find a country that uses practically no gravel, but still has a great deal of concrete construction. There are in Finland two cement manufacturing plants—one, the Pargas-Kalkbergs; the other, the Lojo-Kalkverks. Finland has a considerable deposit of very hard lime-



This equipment is on Swedish seacoast. After passing a series of screens, material is loaded, by gravity, into barges

stone which is called "crystal" limestone. These two cement works control practically all of these deposits. Cement is made from this stone, but each of these companies has an extensive crushed-stone business, and it is this crushed stone which is the principal coarse aggregate used for concrete purposes in Finland.

The quarries and the cement mills in this country are very modern.

The stone deposits now being worked by these companies are overlaid with considerable earth and clay overburden. The Lojo company uses power drag scrapers for the removal of this overburden, while the Pargas company uses slackline cableways. At one of the Pargas plants the overburden is mostly clay and is used in the manufacture of the cement. The cableway at this plant dumps the clay into a car-loading hopper for delivery to the mill.

In addition, the Pargas company uses power drag scrapers in connection with its ground storage of crushed stone, as it maintains a considerable storage of this product in order to promptly take care of customers.

One peculiarity of the Pargas company is the fact that the entire operations of cement manufacture and crushed-stone manufacture are located on an island, and all supplies, such as coal, must be brought to the plant by boat. The products of cement and crushed stone are shipped by boat. At the same time, they have practically no export

business and their entire product is consumed within the country of Finland.

In the city of Helsingfors, the capital of Finland, the Pargas company maintains a very modern central mortar-mixing plant. This is a large plant and supplies the bulk of this product that is used in Helsingfors.

The sand for this mortar plant, as well as the sand for most concrete purposes in Finland, is excavated in some of the small islands lying off Helsingfors. This excavation work is usually done by hand and the material is loaded onto small boats by wheelbarrows. These boats are rather small and probably would not average over 150-tons cargo. These boats bring the sand to Helsingfors and to the one or two other markets or central points of distribution for this material, where they are unloaded and the sand is put in storage in the material yard until it is reshipped to the ultimate buyer. There again we see much use of aerial tramways for the transportation of the material from the boats to the storage yard.

In Russia we find a country that is just beginning its real industrial development. As a result we see sand and gravel prepared by the most primitive methods of hand labor that can be conceived, and then we next see the most modern sand-and-gravel plant that it is possible to conceive.

The supplies of good sand and gravel in this country are very large but, on the other hand, the country itself is so large that one finds great areas in which there is no good material available; and, on account of the distance, the expense of transportation from nearest available site makes the material very expensive by the time it reaches the point of use.

The modern plants that are being put up in Russia incorporate the most modern excavating, washing and screening machinery. Undoubtedly the construction of such plants will continue to the extent that they are justified. Where the demand for material is small and the primitive hand methods of operation are suitable to meet the requirements, undoubtedly those primitive methods will continue for quite some time. On the other hand, where there is a large demand for material and there is a large deposit, we can expect to see a modern plant constructed to meet the requirements of the situation.

Mining and Treatment of Gypsum

(*Continued from page* 44)

super-diesel crude oil engine direct-connected to a 600-kw. alternator.

Accessory services at the mill include a well-equipped machine shop, and a testing laboratory for the necessary control tests and any experimental work desired. The factory itself is a three-story building of asbestos board. The company has also built some houses for employes and a substantial apartment building and hall for single employes.

The amount of gypsum quarried at the gypsum deposit is around 1,000 tons a week, corresponding to about 850 tons of calcined plaster per week. The company produces Waratah plaster, Blue Star hard wall finish, Waratah insulating plaster and Waratah acoustic plaster. It also intends to begin the marketing of Waratah patching plaster in packages of convenient size for the home owner, and of Waratah dental plaster in small quantities.

The company employs 15 men at the gypsum deposit and the Kowulka railroad-loading station and 65 men at the Thevenard mill.

Silica Forms Bond

(*Continued from page* 42)

nia, or liquid sulphur dioxide, with a range of closed piping by means of a small expansion valve, the liquid will absorb heat from the piping, and turn into vapor as long as the external temperature is above that of the boiling point of the liquid. If we now open a valve to connect the piping with a cylinder full of gel, the vapor will be absorbed by the gel until the latter is saturated. Heat is now applied to the gel by an external burner, and the vapor is driven off, through a valve, into a pipe condenser, where it again returns to liquid form, and can be again sent to the piping in the refrigerated chamber. In the States, railway refrigerator vans have been constructed on this plan, and by operating the necessary valves by a thermostat the plant is made automatic, the heat supply being obtained from a cylinder of compressed coal gas placed under the van. This principle is not new, as a very similar plant was constructed some forty years ago, using a strong aqueous solution of ammonia. The gas was driven off by heat, and was condensed to an anhydrous liquid in a suitable condenser, whence it flowed into the expansion piping, being re-absorbed by the water which had cooled down in the meanwhile. As far as my recollection goes, the plant was entirely automatic, with the exception of the necessary stoking, but it was not a success, owing to the vast size of the plant needed to deal with an ordinary cold storage chamber. Its inventor was a man of original mind, and hit upon the true design of cold storage chambers, namely, that they should be constructed as tanks to hold heavy cold air.

In this world of change and decay, where the very molecule itself is continually entering into new alliances, the silica molecule—alone, I think—displays a constancy of resistance which has now been accepted as a very great virtue, and the very word "inert," sometimes applied in a deprecatory sense, can now be held synonymous with the highest of all human virtues—constancy of purpose under adverse circumstances.

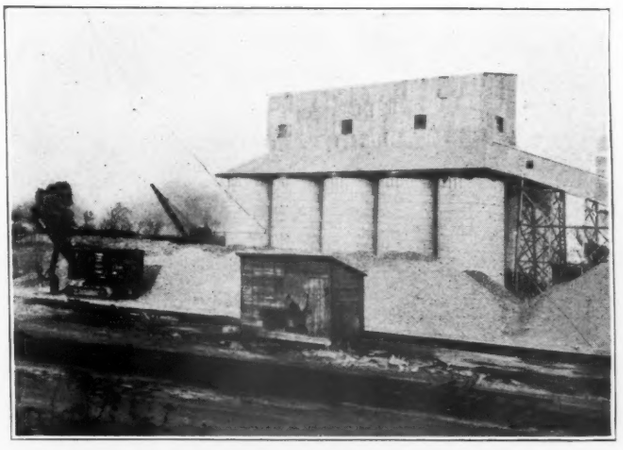
Federal Crushed Stone Company's New Plant Near Buffalo Operates at Capacity from First Day

Simplicity of Design and Minimum of Rehandling Are the Features of This Operation

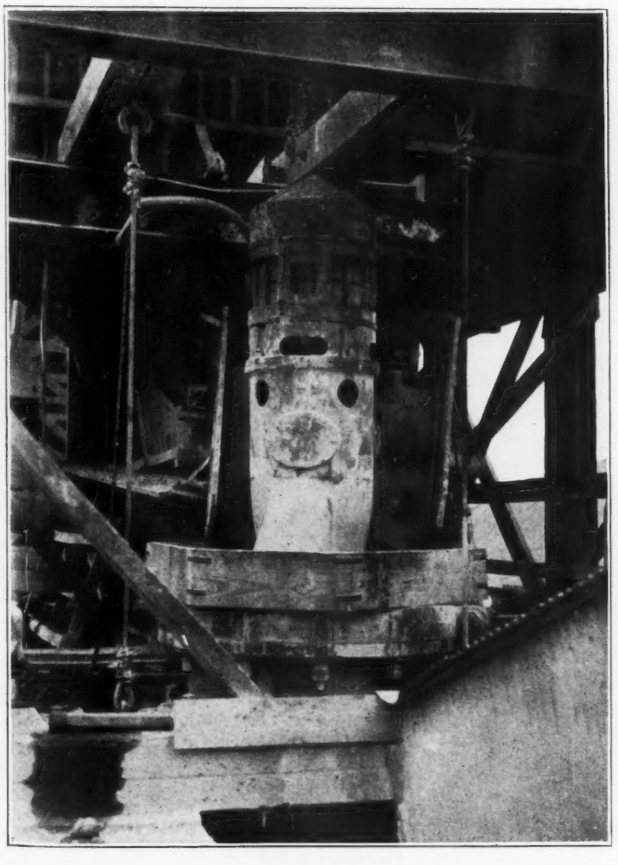
By W. E. TRAUFFER

THE Federal Crushed Stone Company, of Buffalo, N. Y., on June 15 of this year put into operation a new crushed stone plant near that city which takes its place as one of the outstanding new plants of the year. Designed to have a capacity of 300 t.p.h, it has been running at that capacity from the day it went into operation. Simplicity of design is one of the main features of the plant and the limestone deposit is also rather unusual.

The plant buildings are all of the most modern type of construction with concrete floors and foundations and with a few exceptions were all erected by the company's forces. The entire plant was designed by the company's engineers under the supervision of H. E. Rainer, chief engineer and Hugh McNabb, superintendent. The latter was also in charge of construction. The eight 500-tone capacity concrete stave silo bins with steel hoop bracing were erected by the Federal Concrete Company. The steel superstructure, flooring, stairs and corrugated metal siding were furnished and erected by the Lackawanna Steel Construction Company. All other structures are of wood frame construction with corrugated metal siding and roofing.



Screening and storage building from southwest, stockpiling shovel in foreground

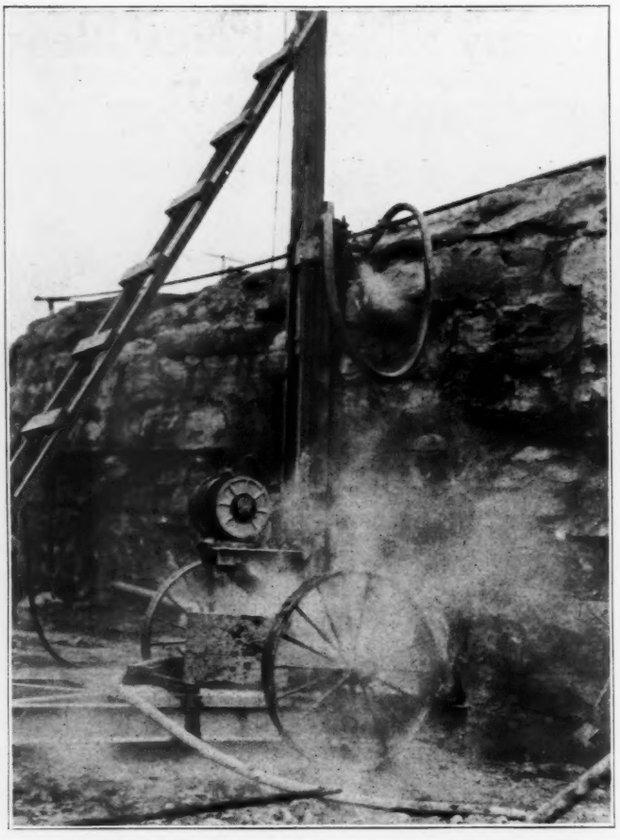


The gearless secondary crusher with scalping screen visible in background

The property was at one time used for coal storage by the Lehigh Valley railroad which runs near the plant. They cut three parallel pits 12 ft. deep, 14 ft. wide and 1,500 ft. long into the rock for loading pits. These were used to advantage when the plant was built, serving as pits for the primary crusher and the two long conveyors and as car and truck loading pits alongside the storage silos. In the quarry the pits served as a start for the first level which has now been expanded to a width of about 200 ft. and a length of over 1,000 ft.

Quarrying Operations

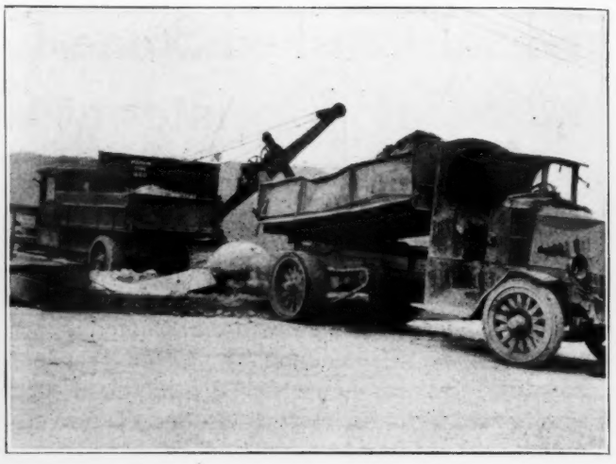
The plant is located on a property of about 100 acres all of which is marketable limestone. The overburden varies from 4 ft. to 12 ft. in depth. The stone is of high quality and lies in the Onondago formation. It is nearly level, having no slope from east to west and less than 4 in. in 100 ft. from north to south. It is entirely free from mud seams and the flint which is so common in the limestone deposits of western New York. The surface of the deposit is as smooth as a concrete pavement and bears the marks of prehistoric glaciers in the form of long scratches running from the northeast to the southwest. Tests made to a depth



New type of air drill with air lift and automatic feed

of 100 ft. show the stone there to be of even higher quality than that near the surface.

Drilling is being done with three Ingersoll-Rand wagon-mounted drifter drills of a new type using 1¼-in. steel. The drill is mounted on a steel support allowing the use of steel up to 18 ft. long and has an extension permitting the use of 30-ft. steel. The outfit is mounted on a wagon with two steel wheels at the drill end and one at the front end. The drill is automatically fed and raised by an air



Trucks discharging to primary crusher, stockpiling shovel in background

hoist and has a centralizer which insures easy starting of the hole. With these drills it is eventually expected to work the quarry in 30-ft. benches. The present level varies between 10 ft. and 14 ft. in depth but a recent bottom shot opened up to a depth of about 30 ft. for the first level. Hercules 60 per cent dynamite and electric blasting caps are used. Gardner-Denver and Ingersoll-Rand jackhammers are used for secondary drilling.

Stone is loaded by a 5-yd. Marion 91 crawler steam shovel into two Pierce-Arrow, two Mack and one White truck of 7½-ton capacity each. These haul the stone a distance of about 1,000 ft. to the plant, the smooth and level quarry floor and the pavement-like surface being ideal for this type of haulage. Later, when the quarry is enlarged and extended further from the plant more trucks will be added. A Marion 1½-yd. Type 460 electric crawler shovel, which is used for stripping and stockpiling, also loads stone when necessary. Later, when the quarry is enlarged, it is expected to use

Five-cu. yd. steam shovel loading unusually large rock into truck. Plant in background

Electric shovel loading truck from stockpile

both shovels in the quarry and to purchase a crane for stockpiling.

Crushing Plant Operations

The trucks discharge at the plant into the Allis-Chalmers 42-in. McCully gyratory primary crusher. This is set into the center tunnel with the top flush with the top of the stone deposit. Trucks can discharge into it from two sides at one time, eliminating delays. The crusher is Texrope driven by a 200-hp. Allis-Chalmers slip-ring induction motor. It discharges onto a 42-in. Rex-Stearns inclined belt conveyor on 180-ft. centers which carries the stone to the secondary crushing plant. This conveyor is driven by a 75-hp. Allis-Chalmers motor through a Falk speed reducer and is equipped with a Cutler-Hammer electric brake to keep the belt from reversing under load in case of power failure.

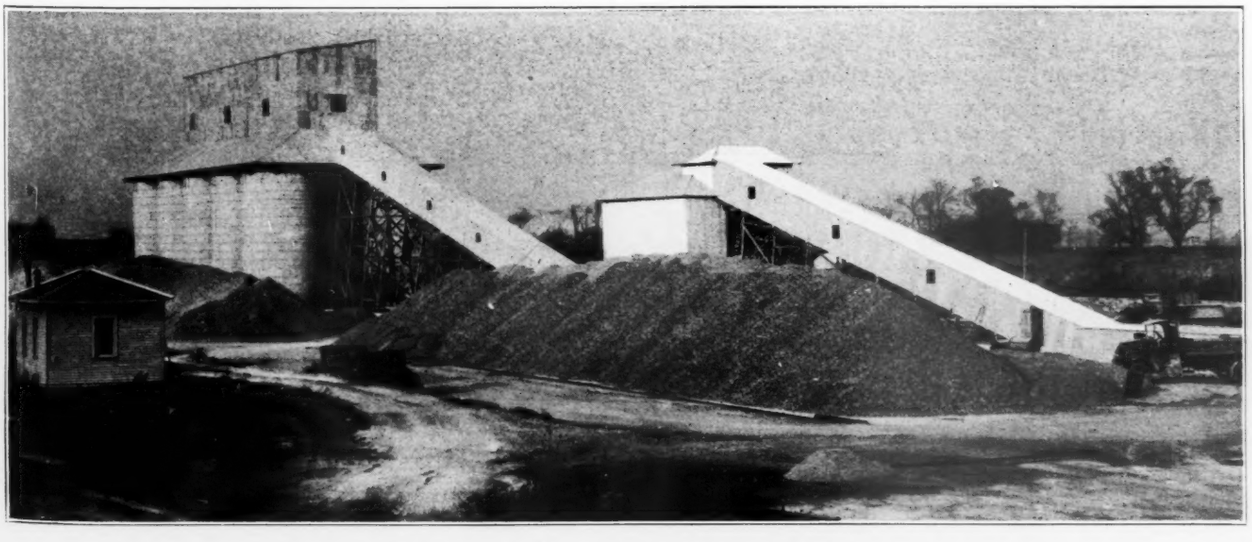
The conveyor deposits the stone into a 150-ton capacity wooden surge bin. A Chain-Belt 36-in. apron feeder discharges onto a Niagara 4-ft. by 6-ft. single-deck vibrating scalping screen with 3½-in. perforations. The coarse stone drops into an Allis-Chalmers "Newhouse" 10-in. secondary

Primary gyratory crusher and main conveyor. Crusher drive and motor at left

crusher and to a 30-in. Rex-Stearns inclined belt conveyor on 261-ft. centers to the screening building. The material passing through the scalping screen goes directly onto the same conveyor. This conveyor is driven by a 50-hp. Allis-Chalmers motor through a Falk speed reducer and has a mechanical ratchet to prevent reversing. The apron feeder is driven through a Falk speed reducer by a 10-hp. motor.

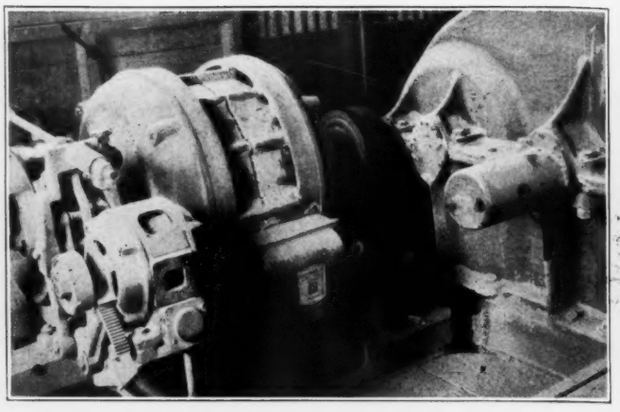
Screening Plant and Storage Bins

The secondary conveyor delivers through a split chute to two Niagara 8-ft. double-deck vibrating



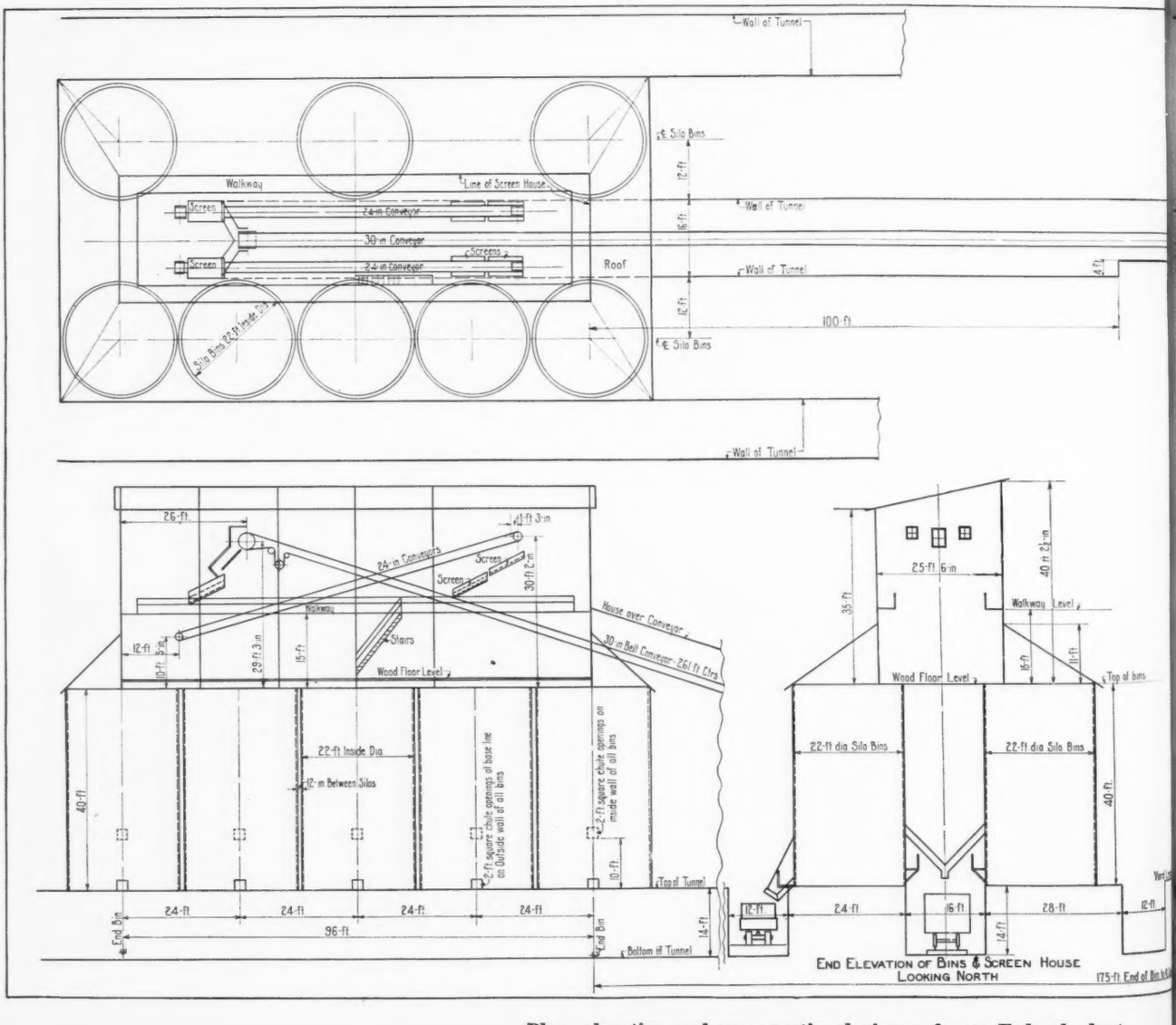
Plant from southwest with office at left. Note smooth pavement-like surface of rock deposit

The first set of four sizing screens, showing motors and drives

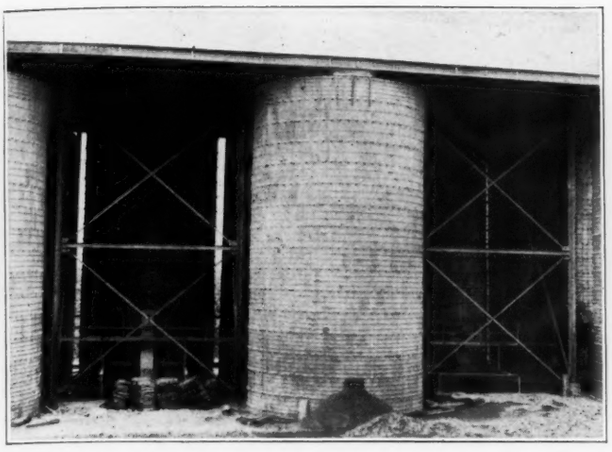


Motor and speed reducer driving main belt conveyor. Magnetic brake at left prevents reversing under load

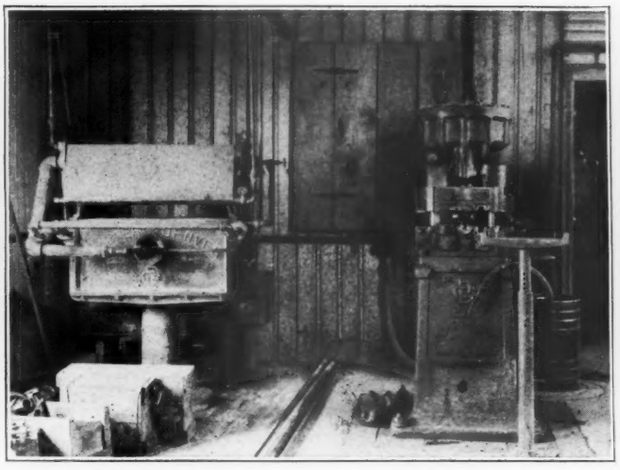
screens. These have 2¾-in. openings on the top and 1½-in. on the bottom decks. Of the three sizes produced the No. 4 and No. 3 stone, off the top and bottom decks respectively, are chuted direct to bins. The stone, under 1½-in., passing through the lower decks, goes to two 24-in. Rex-Stearns inclined conveyors on 72-ft. centers which feed the final sizing screens. Each of these conveyors is driven by an Allis-Chalmers 10-hp. mo-



Plan, elevation and cross-sectional views of new Federal plant.



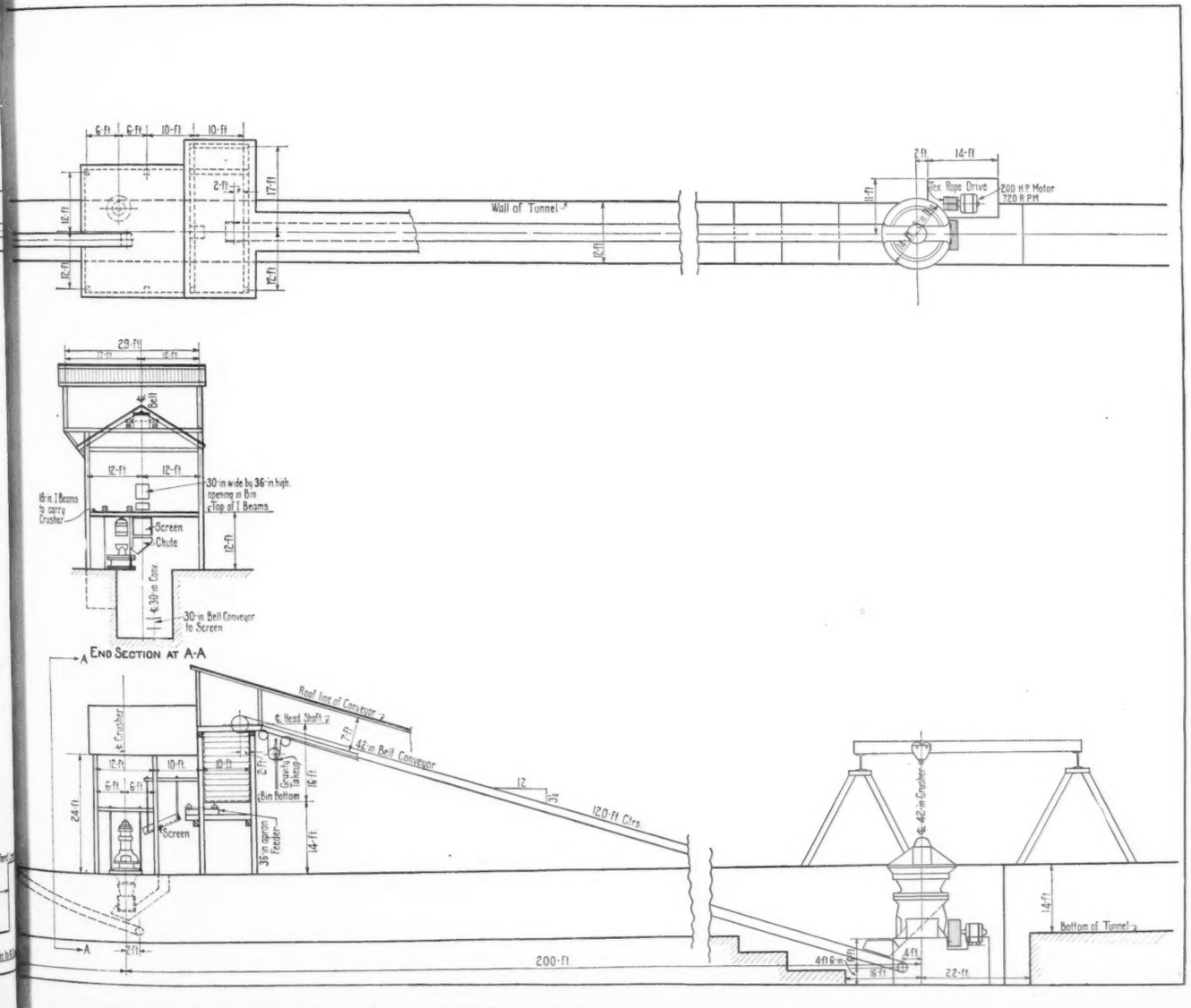
Closeup of bins from east, showing some of gates to cars in tunnel



Drill sharpener and oil treating furnace for air drills

tor through a Falk planetary type speed reducer. All pulleys were furnished by the Chain-Belt Company.

The short conveyors discharge into two sets of final sizing screens, each set consisting of two Niagara 8-ft. vibrating screens. The first screen in each set is single-deck with ⅜-in. mesh for removing screenings. These go directly into bins. The



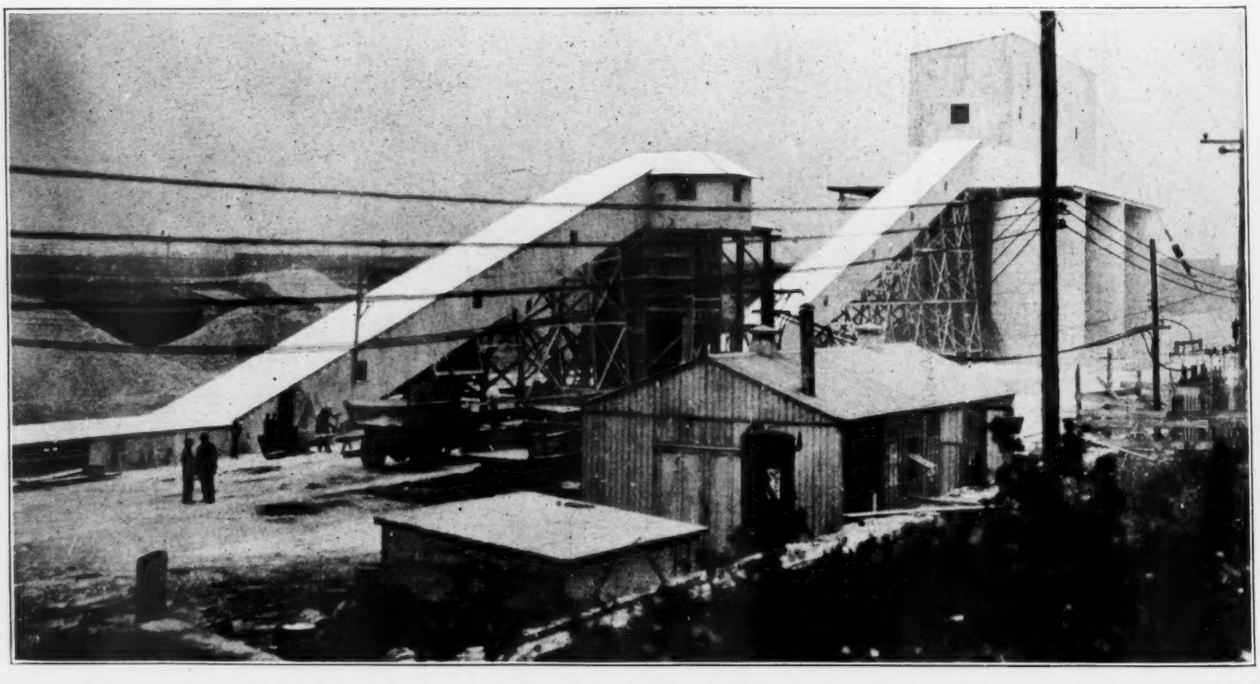
Note three loading tunnels and space left for expansion

Screening and storage plant from north. Car loading tunnel in center, truck tunnel at right

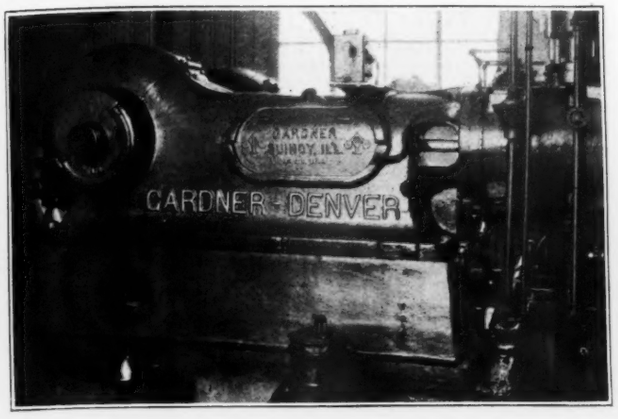
25-ton gasoline locomotive hauling loaded car from loading tunnel

oversize, ⅜-in. to 1½-in., goes to the second screens which are double-deck. These have ⅝-in. mesh on the top decks and ⅜-in. on the bottom decks. The No. 2 and No. 1 stone and the screenings produced go directly to the bins through steel chutes. As previously stated, the eight concrete stave bins have a capacity of 500 tons each. The screenings and Nos. 1, 2, 3 and 4 stone each can be chuted directly into any one of three separate bins. Special sizes can also be made by changing screen cloths on the sizing screens. Eight different sizes can be made at one time by using different sized cloth on each set of screens and in case of a breakdown to any of the screens or short conveyors, the entire load can be shifted to the screens on one side. Each of the screens is Texrope driven by a 5-hp. Fairbanks-Morse motor. The bins are just large enough to fit between the three tunnels, being 22 ft. in diameter, thus allowing the tunnels to be used for loading.

The bins load into trucks in the two tunnels outside of each row of bins through Butler quadrant side-discharge gates. Railroad cars are loaded in



Plant from southeast showing oil storage building and blacksmith shop in foreground. Outdoor substation at right

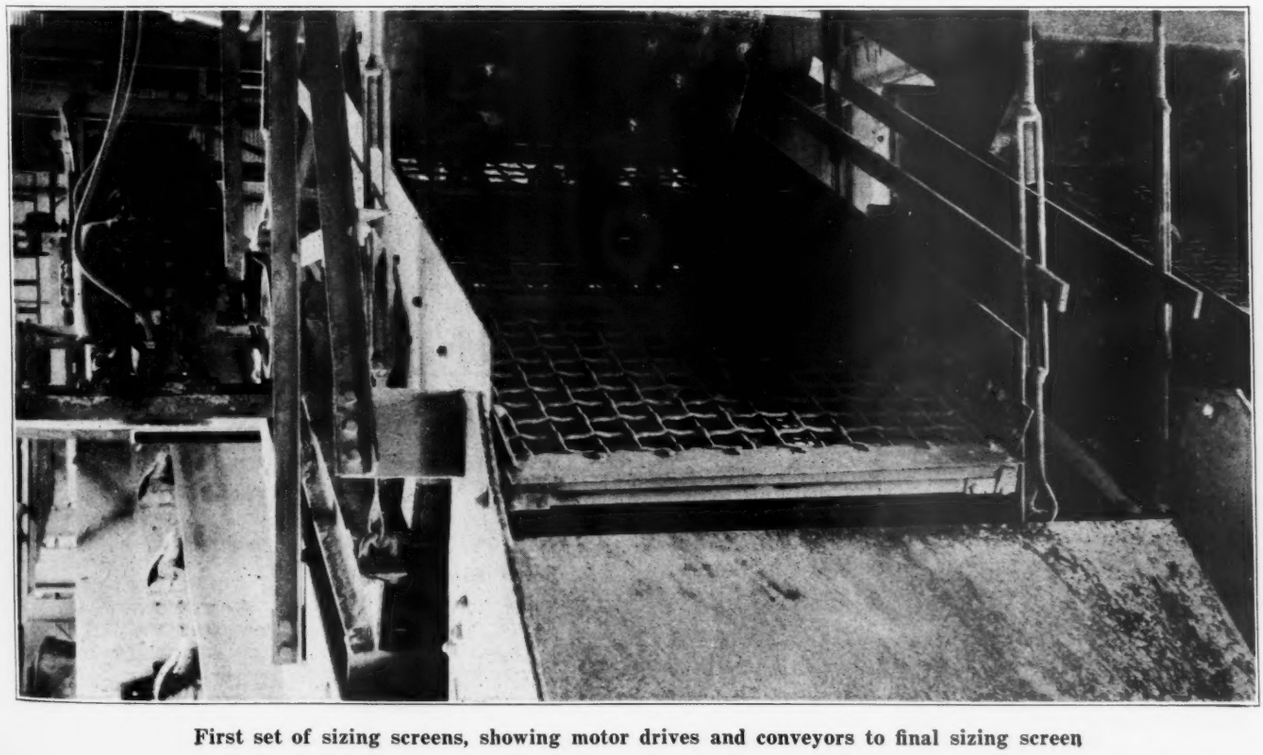


Air compressor for quarry drills

the tunnel between the two rows of bins through Robins radial cut-off gates. One loaded car at a time is hauled to the siding of the railroad by a Plymouth 25-ton gasoline locomotive. Truck loads of stone are weighed out on a Fairbanks 47,000-lb. capacity "Springless" dial scale at the plant office. The smooth surface of the deposit serves as a roadway to the concrete highway along the edge of the property.

An electric siren signal system is used for communication between the screening and crushing plants. The man at the secondary crusher signals the screening plant when operations are to begin, giving ample time to start up the screens and short belt conveyors. Likewise, in case of a breakdown at either end, the machinery can be stopped instantly. The surge bin feeding the secondary crusher automatically signals the man at the primary crusher when the bin is full and he stops the trucks from dumping until the bin is again clear. The conveyor from the primary to the secondary crushers is controlled from the former. The conveyor to the screen house and all machinery in it are controlled by switches on the screening floor.

Tunnels for truck loading, showing type of quadrant gates used



First set of sizing screens, showing motor drives and conveyors to final sizing screen

Floodlights are placed about the plant and all machinery is lighted for night operation.

About 50 per cent of the product of the plant is shipped by truck as the plant is less than 7 miles by road from the heart of Buffalo. Most of this stone is used for concrete and asphalt roads and for general construction work.

A second Newhouse secondary crusher is to be installed this winter alongside the present one. This one will be set to crush to 1½-in. size, the present crusher being set at 1-in., giving greater flexibility of stone sizes. A return conveyor will also be installed on the outside of the present row of five bins allowing excess large stone from these bins to be returned to the secondary crusher for recrushing. Tentative plans are also being made to install some method of rinsing the stone before it goes into the bins. There is ample space between the screens and silos for any installation of this kind. The crushers and conveying equipment were designed to carry more than twice their present capacity of 300 t.p.h. and only additional screens would have to be added to give greater capacity. Space has also been left for two more bins.

Miscellaneous

An extremely neat machine and blacksmith shop is maintained at the plant. It has a concrete foundation and floor and the building itself is of sectional all-steel construction. It was furnished by the Blaw-Knox Company. The drill-sharpening equipment is unusually complete, consisting of a Buffalo Forge Company forge, a Gardner-Denver Model 8 drill sharpener and an oil-treating furnace of the same make. There are also an electric grindstone, drill press and miscellaneous small tools. Neat racks contain all sorts of bolts and small parts. In an adjoining room there is a Gardner-Denver 18-in. by 12-in. by 12-in. compressor which is belt driven by a 200-hp. Crocker-Wheeler synchronous motor. A small building nearby is used to store all oil and grease needed about the plant.

The company has its own source of water supply in a 104-ft. well on the property. A Rumsey deep well pump feeds a 150,000-gal. capacity steel tank on higher ground north of the plant. Water is piped to the plant through a 6-in. line. A Buffalo Steam Pump Company's 250-g.p.m. centrifugal pump is kept in case of fire. This is housed in a small building near the screening plant and is direct-driven by a 40-hp. General Electric motor. It is so connected up that it can also pump to the steam shovel or compressor lines if desired. Power is received at 11,000 volts and is reduced in an outdoor substation to 440 volts for general plant use.

The main office of the company is at 866 Ellicot Square, Buffalo, N. Y. Officers are: H. N. Synder, president; Mark Kyler, vice-president; and Hugh McNabb, secretary, treasurer and plant superintendent.

White Rock Quarries Keeps Abreast

(*Continued from page 29*)

As previously stated, the plant was electrified in 1925, but early this year a new and larger substation was erected and the power house rebuilt. This is of concrete block construction and General Electric equipment is used.

Safety

Unusual attention is given to the safety of the employees and the plant has a very good safety record as a result. There are 14 first-aid teams, all of which have passed the tests of the Bureau of Mines. All employees are encouraged to make suggestions for increasing safety or improving operations and are given a bonus if their suggestions are accepted. Most of the employees, especially those in the crushing, kiln and hydrating departments, are old hands, some of them having been employed at this plant for over 18 years. All of the foremen have risen from the ranks.

The main office of the company is maintained in Bellefonte. Officers are: W. Fred Reynolds, president; A. Fauble, vice president; Ray C. Noll, treasurer and general manager, and L. A. Schaeffer, secretary. W. E. Saxion is superintendent.

Ohio Finishing Lime Association Holds Meeting in Toledo

The annual meeting of the Finishing Lime Association of Ohio was held Friday, November 15, at the Commodore Perry Hotel, Toledo, Ohio.

The Association representing 75 per cent of the finishing hydrated lime production in the world, and producing approximately 50 per cent of the country's production of hydrated lime, is strongly united through cooperative effort for the purpose of carrying on a national, educational, and promotional campaign, towards the extension of the use of their product in construction, as well as the maintenance of a high standard of quality.

The following were elected to offices for the coming year:

President—G. C. Urschel, The Woodville Lime Products Co.

Vice-President—A. B. Mack, The Kelley Island Lime & Transport Co.

Treasurer—L. G. Love, The National Lime & Stone Co.

Secretary and General Manager—L. E. Johnson.

The retiring officers who have served since the beginning of the Association are:

Fred Witmer, president, The Ohio Hydrate & Supply Co.

E. C. Swessinger, vice-president, The Kelley Island Lime & Transport Co.

G. H. Faist, treasurer, The Woodville Lime Products Co.

The following are members of the Finishing Lime Association of Ohio:

The Gibsonburg Lime Products Co., Gibsonburg, Ohio.
The Kelley Island Lime & Transport Co., Cleveland, Ohio.
The National Lime & Stone Co., Findlay, Ohio.
The National Mortar & Supply Co., Pittsburgh, Pa.
The Ohio Hydrate & Supply Co., Woodville, Ohio.
The Woodville Lime Products Co., Toledo, Ohio.

Characteristics of Various Types of Primary and Second Crushers

By G. B. MASSEY

SEVERAL types of crushers are in use in quarries today. They are known as the gyratory crusher, the jaw crusher, the single-roll and the double-roll crusher.

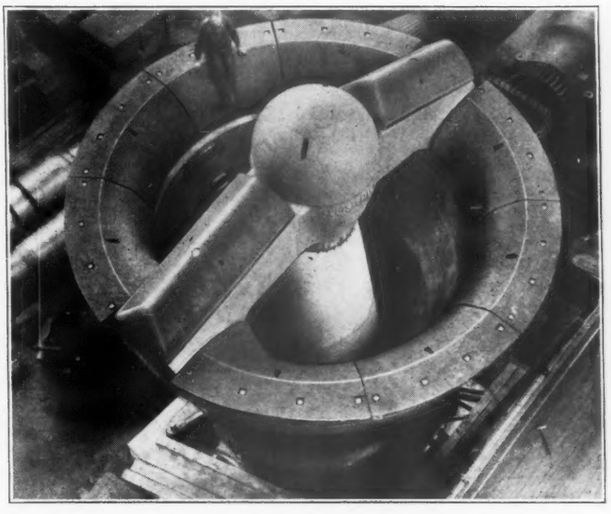
The *gyratory crusher* is sometimes built in very large sizes, the largest having two feed openings, each 60 in. by 150 in., with an overall diameter of 19 ft. 9 in. Such a crusher will handle practically everything loaded by a modern loading shovel.

There are probably more gyratory crushers in use than any other type, the principal advantage in their use being that the product of the crusher contains less slabs than is the case with any of the other types. The reason for this is that the outlet opening is curved in the arc of a circle and a slab is usually broken before it can go through.

The *jaw crusher* is being used also in large numbers but is not so popular as the gyratory crusher except in the case of soft limestones or shales.

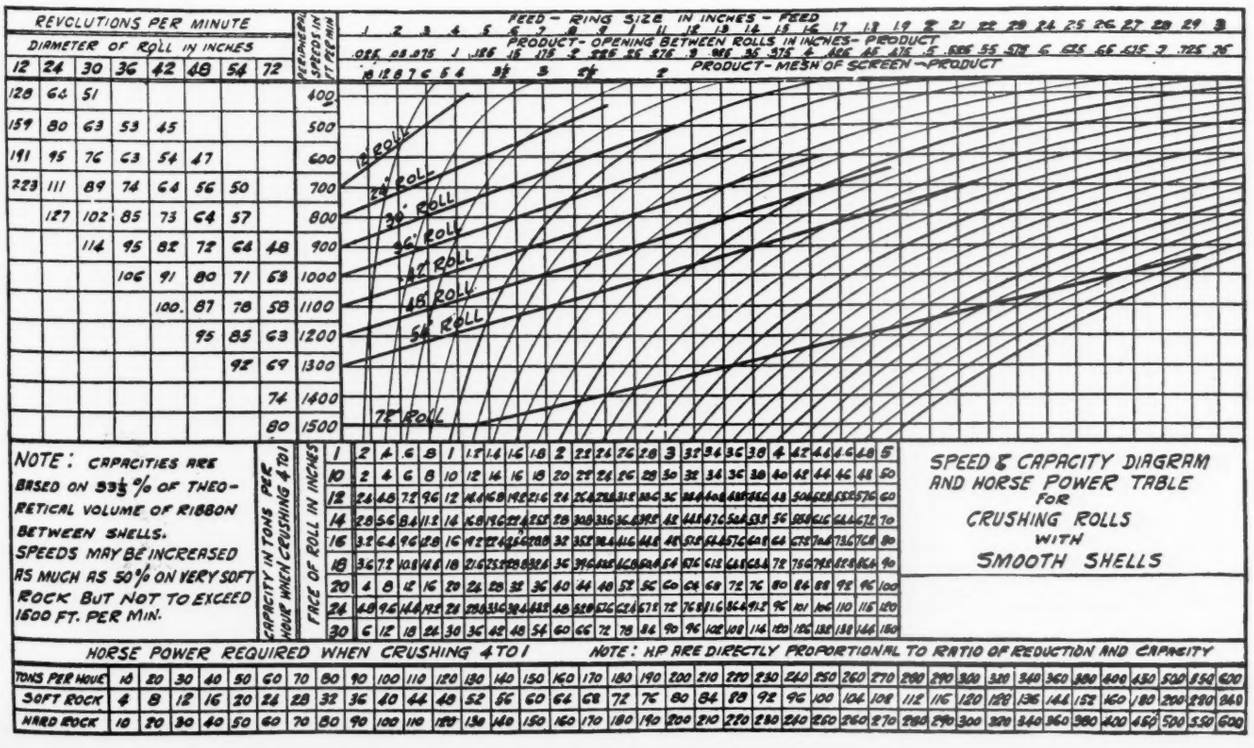
The *single-roll crusher* is used to a less extent than the two foregoing types. The *double-roll crusher*, with its very large consumption of horsepower, is not used to any great extent for primary crushing.

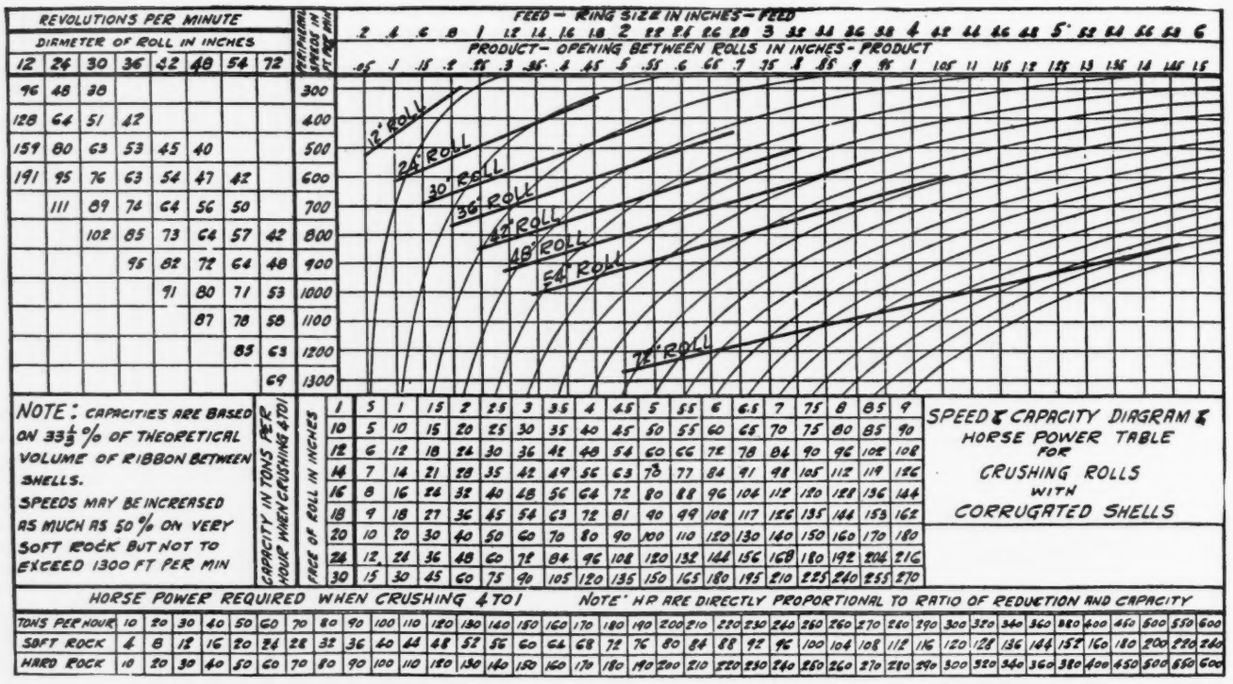
The present heavy-duty quarry-loading shovels, with 3-cu. yd. and 4-cu. yd. dippers and tremendous bail-pull, are able to load large blocks of stone, but the largest size crushers are able to take care of them. The size of a primary crusher is fixed usually by the size of blocks that the loading shovel will handle rather than by the capacity desired.



Looking down into 60-in. all-steel gyratory crusher

On the other hand, secondary crushers usually must be selected on the basis of their capacity rather than the size of stone they can handle. The ideal secondary crusher is one which will take comparatively small stone, the crusher itself being small, while its capacity is large.

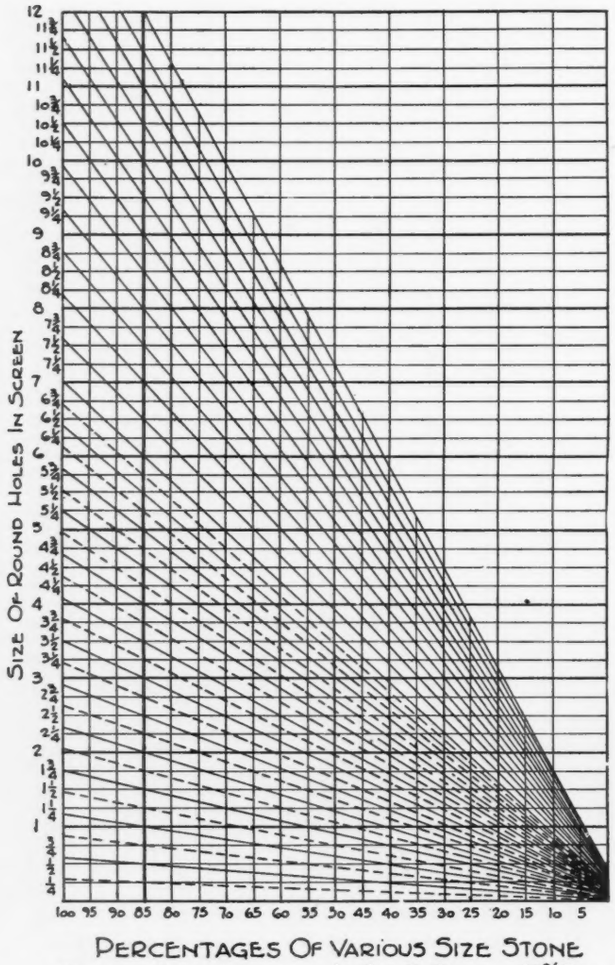

REVOLUTIONS PER MINUTE
DIAMETER OF ROLL IN INCHES
12 24 30 36 42 48 54 72
PERIPHERAL SPEED IN FT. PER MIN.
FEED – RING SIZE IN INCHES – FEED
PRODUCT – OPENING BETWEEN ROLLS IN INCHES – PRODUCT
PRODUCT – MESH OF SCREEN – PRODUCT
12" ROLL
24" ROLL
30" ROLL
36" ROLL
42" ROLL
48" ROLL
54" ROLL
72" ROLL
NOTE: CAPACITIES ARE BASED ON 33⅓ % OF THEORETICAL VOLUME OF RIBBON BETWEEN SHELLS. SPEEDS MAY BE INCREASED AS MUCH AS 50% ON VERY SOFT ROCK BUT NOT TO EXCEED 1500 FT. PER MIN.
CAPACITY IN TONS PER HOUR WHEN CRUSHING 4 TO 1
FACE OF ROLL IN INCHES
SPEED & CAPACITY DIAGRAM AND HORSE POWER TABLE FOR CRUSHING ROLLS WITH SMOOTH SHELLS
HORSE POWER REQUIRED WHEN CRUSHING 4 TO 1
NOTE: HP ARE DIRECTLY PROPORTIONAL TO RATIO OF REDUCTION AND CAPACITY
TONS PER HOUR
SOFT ROCK
HARD ROCK


REVOLUTIONS PER MINUTE
DIRMETER OF ROLL IN INCHES
12 24 30 36 42 48 54 72
PERIPHERAL SPEED IN FT PER MIN
FEED — RING SIZE IN INCHES — FEED
PRODUCT — OPENING BETWEEN ROLLS IN INCHES — PRODUCT
12" ROLL
24" ROLL
30" ROLL
36" ROLL
42" ROLL
48" ROLL
54" ROLL
72" ROLL
NOTE: CAPACITIES ARE BASED ON 33⅓ % OF THEORETICAL VOLUME OF RIBBON BETWEEN SHELLS.
SPEEDS MAY BE INCREASED AS MUCH AS 50 % ON VERY SOFT ROCK BUT NOT TO EXCEED 1300 FT PER MIN
CAPACITY IN TONS PER HOUR WHEN CRUSHING 4 TO 1
FACE OF ROLL IN INCHES
SPEED & CAPACITY DIAGRAM & HORSE POWER TABLE FOR CRUSHING ROLLS WITH CORRUGATED SHELLS
HORSE POWER REQUIRED WHEN CRUSHING 4 TO 1
NOTE: HP ARE DIRECTLY PROPORTIONAL TO RATIO OF REDUCTION AND CAPACITY
TONS PER HOUR
SOFT ROCK
HARD ROCK

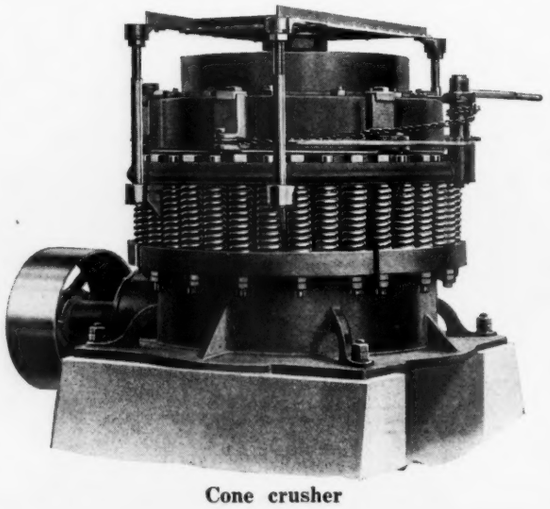
Heretofore, secondary crushing has been done usually with fairly large gyratories, with openings for relatively large stone but with very limited capacities, involving several crushing operations to reduce the material to the desired size. The solution of this secondary crushing problem has been found in the modern high-speed secondary crusher, still of the gyratory type, but without bevel gears or drive pulley. This new type is driven at high speed by a vertical motor that is direct-connected to the gyratory shaft.

Because of the high speed and the masses involved, these crushers must be suspended usually by wire ropes, from points above them, to permit the crushers to adjust themselves to the gyratory motion. These crushers are built in three sizes of openings, to take 7-in., 10-in., or 14-in. stone; and they will crush to ¾-in. for the first two sizes, and to 1⅛-in. for the last. The high speed assures high capacities.

The largest gyratory can deliver to one or more smaller gyratories, and these, in turn, can deliver to the high-speed gyratories for final reduction.



PERCENTAGES OF VARIOUS SIZE STONE
PRODUCED WHEN CRUSHER IS SET TO PRODUCE 85% THRU GIVEN SIZE HOLES IN SCREEN
COURTESY OF ALLIS-CHALMERS



Cone crusher

Capacities and Power Requirements of High Speed Gyratory Reduction Crushers

Size of Crusher	Capacities in tons per hour of material weighing 100 lb. per cubic foot and 2,000 lb. per ton															Horsepower	Full load speed of motor and gyrations of head per min.		Net Weight in Pounds
Width openings, on open side, to produce product 85% passing ring size in flat screen	¾	⅞	1	1⅛	1⅜	1½	1¾	1⅞	2	2⅛	2¼	2½	2¾	3	3½		50 Cycle Motor	60 Cycle Motor	
7-inch	25	30	34	38	56	62	69	76	83	90	97	....	....	....	....	60	720	865	23,000
10-inch	33	40	45	51	74	83	92	101	137	150	162	175	....	....	....	100	575	690	45,000
14-inch	....	....	....	99	110	140	160	180	200	216	232	264	296	328	382	150	575	695	113,000

Capacities specified above vary, depending on regularity of feed and manner in which stone breaks in crushing. These figures are conservative and based on actual operation.

Size-Percentage Diagram

To determine the sizes of crushers to use for the crushing, the accompanying diagram may be consulted. This shows, for any setting of the primary crusher, what percentages of the different sizes of stone will be contained in the product from the primary crusher, as will be explained presently.

Any crusher is greatly retarded by the mixture of small material with the large; hence, after each crushing operation, a scalping device should be used to remove all stone which would pass through the discharge opening of the next crusher. This provides that every stone that comes to the next crusher will be acted upon by that crusher.

For the large stone in the primary crusher, the scalping should be done by multi-rolled sizers which not only act as scalpers but also as feeders, and are of such strength and durability that they will stand up under punishment which would make the use of screens impossible. To know just what percentage of the output of a crusher will be removed by the scalping device, the diagram can be used.

The horizontal lines represent the size of screen or ring in inches. The vertical lines represent the percentages of the various sizes which will result from the crushing operation. It has been found that, in the average product of any crusher, 15 per cent of the material will be oversize, so a heavy line is placed at 85 per cent.

To use the diagram, the size of the screen or ring is identified and its horizontal line is followed to the 85-per cent vertical line, from which a diagonal line is followed until it crosses the horizontal line representing the desired size. From the junction of the diagonal and the horizontal line so found, the vertical line is followed to the bottom of the diagram, where the percentage of that size of material can be read.

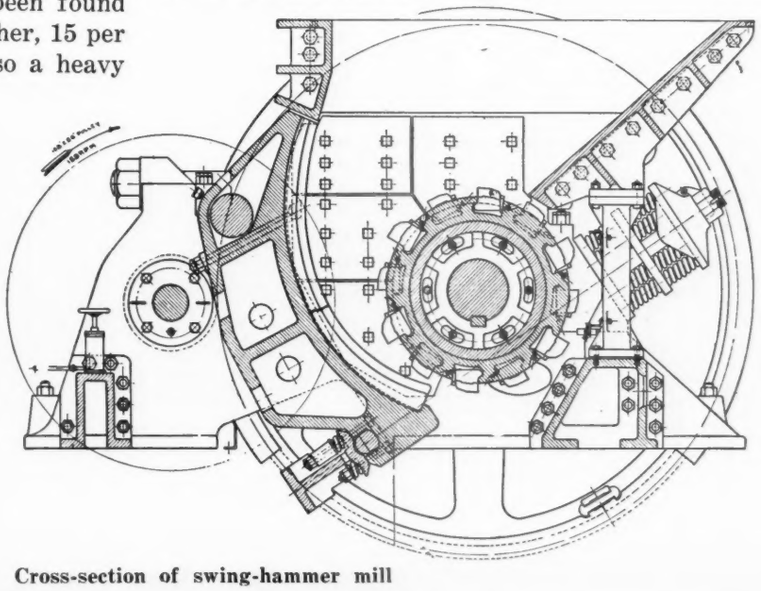
For example, a 5-in. setting of opening of a crusher will result in 32 per cent of the product being of 2-in. screen or ring size; 53 per cent between 2-in. and 5-in., and 15 per cent over 5-in.

As the material becomes smaller in size in going through the plant, the scalping may be done by screens which also do the sizing.

In addition to the old-style gyratory reduction crusher and the new high-speed gyratory reduction crusher, there are several other types of crushers in use.

Pot crushers are useful for soft materials such as gypsum or coal, and for cracking up cement clinkers. They are built to size, to handle one sort of stone.

Swing-hammer mills also are used. Of late years, their sizes have been increased so that they can handle up to 36-in. cubes. Such mills can, therefore, be used as primary crushers if small loading machines are used in the quarries. The ratio of reduction is larger in a swing-hammer mill than in any other crushing or pulverizing machine, as a 36-in. cube can be reduced to 1-in. and finer in one operation. Swing-hammer mills are particularly useful on sticky, gummy, or wet materials which would be impossible to handle in any other type of crusher. Hammer mills can be had up to 350-tons-per-hour capacity.



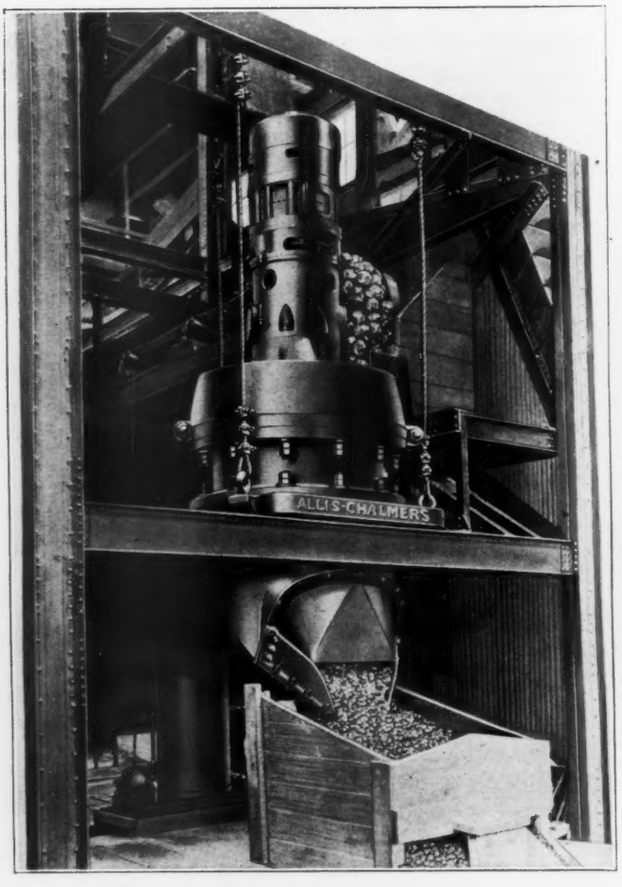
Cross-section of swing-hammer mill

Disc crushers are also in use for secondary or reduction crushers. The disc crushers are made with discs ranging in diameter up to 48 in., taking feed up to 6⅛-in., with a capacity up to 120 tons per hour.

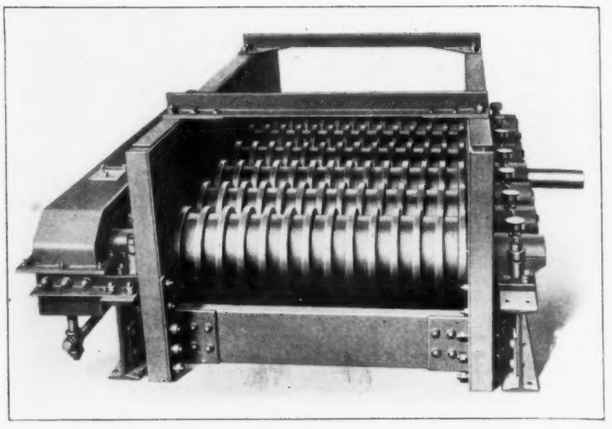
One type of gyratory crusher has the secondary shaft stationary, with the head mounted on an eccentric sleeve which, in turn, is mounted on the central shaft. This construction permits of a very low-built crusher.

Rolls are particularly effective as reduction crushers, the reduction ratio being four to one. All rolls should have feeders which will supply them continuously with stone at a uniform rate as close as possible to the maximum quantity the rolls will pass, and in a stream the full width of the roll faces.

Referring to the diagrams, one is for corrugated-shell rolls, the other for smooth-shell rolls. At the top is given the size of the rock fed in, in inches, and below is the size of the product when reduced four-to-one. Following down the vertical line, the first diagonal line across indicates the minimum size of roll which can be used; and from that point of intersection following the horizontal line at the left gives the speed in feet per minute, and still following the horizontal line at the left is found the revolutions per minute.



Suspended high-speed gyratory crusher



Grizzly with seven 12-in. rolls, square openings

By following the parabolic line from the foregoing intersection down to the table below, the capacity in tons per hour can be read opposite the figure at the left, giving the width of face of the roll in inches. Thus, with smooth shells, 1-in. feed and ¼-in. product requires the minimum roll of 30-in. diameter, 550 f.p.m., 69 r.p.m. and 12 tons per hr. for 12-in. width of face of roll.

In gravel operations the crusher is usually installed to handle the oversize, crush it, and return it for rescreening. These crushers need not have large capacity nor take very large pieces, but some pieces of gravel are apt to be very hard and the crusher should be adapted to this class of material.

Bonus System Materially Reduces Accidents at Cement Plant

The beneficial results of the inauguration of the bonus system as a means of reducing accidents at the Victoryville, California, cement plant of the Southwestern Portland Cement Co., are discussed in Information Circular 6176, recently published by the United States Bureau of Mines, Department of Commerce.

This company has long been interested in safety and has for several years been making an earnest effort to reduce the number of lost-time accidents, says Emory Smith, first-aid miner, in the circular. Recently the accident-prevention methods in vogue were supplemented by the introduction of a bonus system. The employes were arranged in ten teams, so grouped as to equalize the hazard as far as possible. From 25 to 30 men compose a team and any team completing a month without lost time due to an industrial accident is given a bonus of 1 per cent of its monthly pay. In case an accident occurs, however, the team of which the victim is a member does not receive a bonus for any month during which the accident causes a loss of time. The system is freely described on page 51, November 20, PIT AND QUARRY.

Phoenix Utility Company Furnishes Mixed Concrete For Hydro-Electric Development

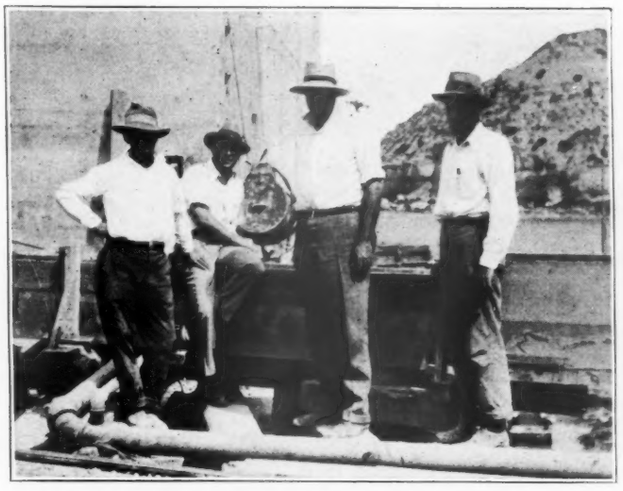
Pit-Run Gravel Shipped Forty Miles and Washed at Morony Dam Site

By FRANCIS CHURCH LINCOLN
Professor of Mining, South Dakota State School of Mines, Rapid City, S. D.

[*This article describes a plant which, although of substantial proportions, is intended to serve solely a single engineering project.. It embodies equipment and methods that can be applied to other construction projects requiring large quantities of concrete.—Editor.*]

THE Phoenix Utility Company, of 2 Rector Street, New York, N. Y., is engaged in the construction of the Morony Hydro-Electric Development for the Montana Power Company. This project is located 17 miles down the Missouri river to the northeast of Great Falls, Mont. Ground was first broken at Morony in December, 1928, and the pouring of concrete began on April 11, 1929.

A dam 95 ft. in height above the river bed and about 850 ft. in length is under construction to



The staff (left to right): James Traynor, general foreman; S. D. Cresswell, materials engineer; C. H. Tornquist, construction superintendent; F. D. Miles, inspector

The concrete mixing plant at Morony dam

Inclined silo for cement

add some 62,000 hp. to the capacity of the company's system. Pit-run gravel for concrete aggregate is purchased from C. R. Tintinger, who excavates it with draglines from pits situated some 40 miles southwest of Great Falls near the town of Cascade. A plant at the dam washes and separates the sand and gravel in the pit-run mixture, recombines them in the proper proportions for the desired concrete, and mixes them with the correct amounts of portland cement and water. The Poenix Utility Company has developed this gravel washer and concrete plant to the point that it can be used successfully, with slight modifications, for any large concrete work where gravel is available.

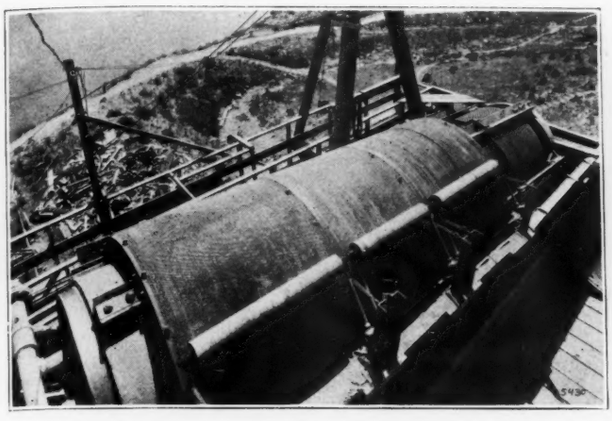
The pit-run gravel shipped from the Tintinger pits has had all boulders over 4 in. in diameter removed by a grizzly. It is received at Morony in bottom-dump cars which discharge their contents into a track hopper near the washer. The machinery for the washer was furnished by the Smith Engineering Works of Milwaukee.

A 30-in. by 5½-ft. Telsmith plate-feeder delivers the gravel from the bottom of the track hopper to a 24-in. Telsmith belt conveyor which carries it up a gentle slope for 86 ft. to the washing-box above a 20-ft. Telsmith Ajax gravel washer. There it is mixed with water and flows into the 20-ft. revolving screen of the washer which is 60-in. in diameter and perforated with 1-in. round holes. Encircling the upper portion of this revolving screen is a second screen, 78 in. in diameter, and 14 ft. in length, composed of three sections, the first of which is perforated with 5/16-in. round holes and the other two with ¼-in. round holes. Each section is provided with a cleaning roller on the outside.

The Ajax washer and the 24-in belt are both driven by a 40-hp. electric motor, and the belt itself drives the plate feeder by means of a chain drive through a clutch working upon the belt pulley at the opposite end of the belt from the motor drive.

The sand passing the outer screen of the gravel washer is washed in a No. 8 Telsmith sand-tank and is recleaned in a Telsmith twin-screw rewasher, the latter being driven by a 10-hp. motor.

General view of the sand and gravel, and the concrete-mixing plants



Gravel washing screens

Track hopper, plate feeder and belt conveyor at washery

The coarse gravel, 4 in. to 1 in. in diameter; fine gravel, 1 in. to ¼ in. in diameter; and sand, 5/16 in. and under, collect in piles beneath the washer. They are recovered by means of a 24-in. horizontal Telsmith belt conveyor, 100 ft. in length, which runs in a tunnel underneath the piles of aggregate from which it is fed by means of eight Boquad bin-gates. This belt is driven by a 5-hp. motor and delivers its load to another 24-in. Telsmith belt conveyor which is inclined and carries whatever material is fed upon it up to the turntable chute of the mixing plant. The washer requires the services of two men only, one on top and the other in the tunnel below.

The dam concrete contains 1.15 barrels of portland cement to the cubic yard. The cement is purchased from the Hanover and Trident plants of the Three Forks Portland Cement Company which were described in the November 6 and November 20 issues of PIT AND QUARRY. The cement is sampled in the bins at the cement mills, one sample being taken for each 200 bbl. of cement. Bins are then held for 28 days when, if tests show their contents are up to standard, they are released for shipment. The cements from both plants are of high quality and, while differing considerably in chemical compositions, they respond to tests equally well. The concrete produced from them usually develops a compressive strength of 2,000 lb. per sq. in. at 7 days; 3,800 lb. at 28 days; and 4,500 lb. at 60 days.

The cement is shipped in bulk in box cars. It is unloaded at Morony by a Stephens-Adamson power scraper into an inclined silo located beside the

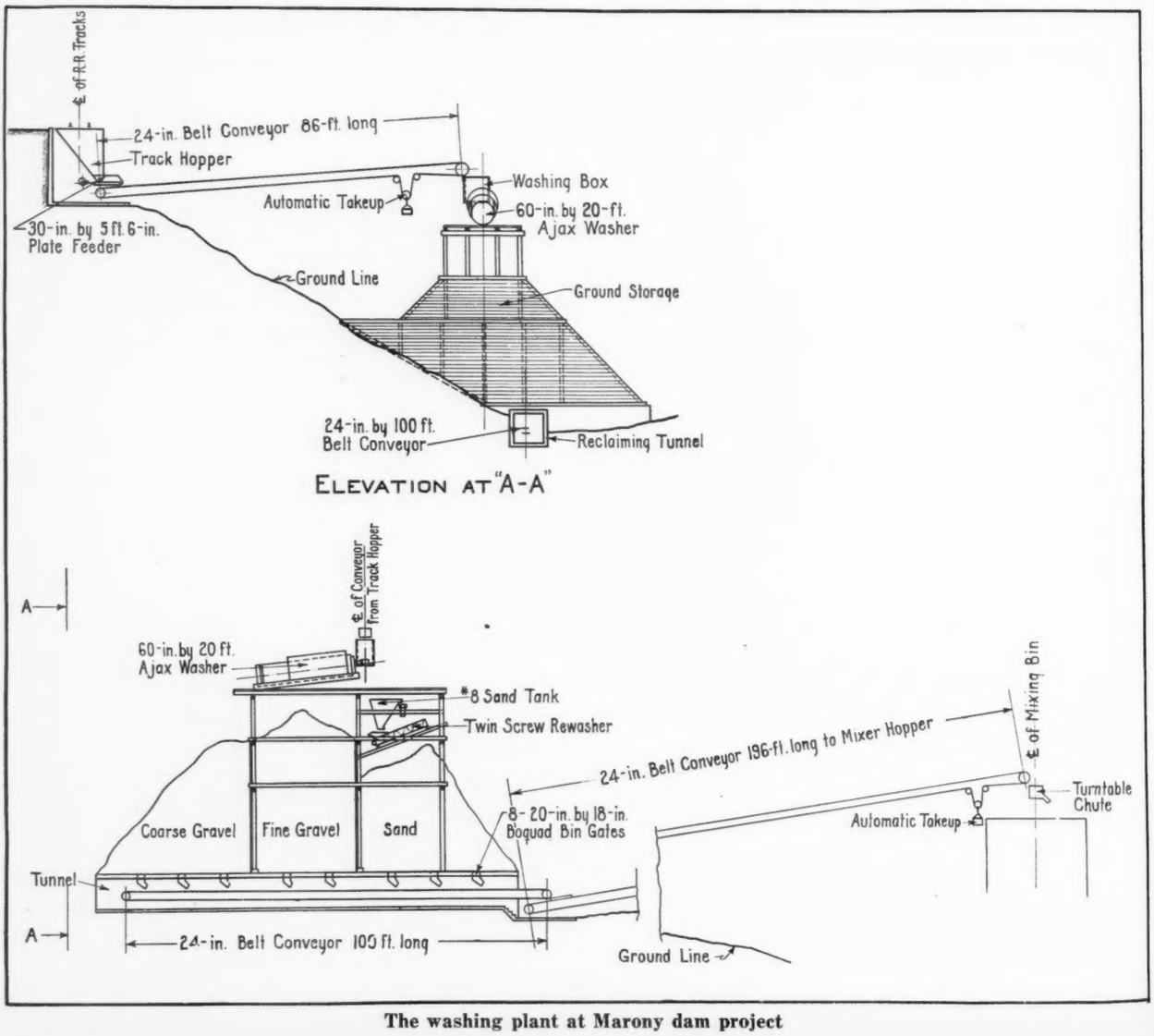
The sand and gravel washery

The sand-and-gravel washery; dam at left; Missouri River in background

The washery, with engineering office in distance

track and capable of holding eight carloads. From this silo it is delivered through a gate by means of a screw conveyor to an 18-in. conveyor belt which carries it to the cement bin over the mixing plant.

Coarse gravel, fine gravel, and sand are transported from the washer to bins at the top of the concrete plant upon one 24-in. belt conveyor 196 ft. in length, driven by a 20-hp. motor. This conveyor carries but one kind of aggregate at a time,



The washing plant at Marony dam project

dumping it into a turntable chute which can be turned to discharge into any one of three bins, according to the material which the belt is transporting. The pit-run gravel does not produce quite sufficient sand for the desired mixture, so a small amount of extra sand is purchased from Mr. Tintinger to correct the deficiency. Portland cement is carried from the cement silo to a fourth bin above the concrete plant upon an 18-in. belt conveyor driven by a 6-hp. motor.

The aggregate is proportioned by weighing in a special Blaw-Knox hopper upon a Fairbanks springless scale, a second hopper and scale being employed to weigh the cement. The concrete is prepared in two 2-cu. yd. S 56 cement mixers made by the T. L. Smith Company and each run by a 40-hp. motor. About equal parts of fine and coarse gravel are used in the aggregate, with slightly less of sand than of either size of gravel. A regular 2-cu. yd. batch contains about 6,850 lb. of aggregate, 865 lb. of cement, and 50 gal. of water. It is mixed for 2 minutes, the time being measured by 2-minute glasses made from Mason jars containing sand and operated in the same manner as the old-fashioned hour glass.

The concrete plant requires the services of three men, one on top attending to the reception of the raw materials and two on the mixing floor below. As a check on the mixing, two Esterline-Angus recording watt-meters have been installed in the testing laboratory and are connected with the mixers. These instruments indicate, by their records, whether the weights, times, and consistencies of the different batches were correct.

C. H. Tornquist is construction superintendent for the Morony Hydro-Electric Development. He is an experienced engineer who has worked for the Phoenix Utility Company on many other jobs. F. D. Miles is inspector and is responsible for the quality of the concrete. He has been with the company for 12 years. James Traynor is general foreman. He has been for many years a trusted employee of the Montana Power Company. There are from 400 to 500 men employed on this project and the monthly payroll is about $80,000. The gravel washer and concrete plant are operated at a minimum cost for labor and are of the greatest importance to the economy and success of this big enterprise.

Reviews Work of Pennsylvania Geologic Bureau

Dr. George H. Ashley, state geologist, in a statement today reviewed the work of the topographic and geologic survey bureau in the Department of Internal Affairs in the ten-year period during which it has been functioning.

Dr. Ashley was named to the post he now occupies in September, 1919, by James F. Woodward, secretary of internal affairs. Plans for active functioning of the newly created bureau were drafted immediately.

Since that time about 10,000 persons have called at the survey bureau in person or by phone and have had their inquiries answered and about 50,000 inquiries by letter have been answered so far as information was available. During that time the advice of the survey probably has saved the citizens of Pennsylvania many millions by preventing unwise investments. It also is believed the advice given has led to the investment of many other millions. This advice has ranged from the identification of specimens to municipal water supplies, dam sites, city expansion programs, materials for highway building, prevention of stream pollution, but of course mainly on the probable presence, depth, quantity of mineral deposits at any place or under specified tracts of land, or near towns seeking to increase their industries.

Maps State Surface

The survey working in co-operation with the U. S. Geological Survey, U. S. Bureau of Mines and other Federal and State agencies, has mapped topographically 11,000 square miles, or 24.8 per cent of the state's surface, has mapped geologically sixteen quadrangles or 3600 square miles, in addition to an even larger area mapped by the Federal Geological Survey. It has made or has in progress comprehensive preliminary surveys of deposits of coal, oil and gas, oil shales, clays, building stones, slate, sandstone, limestone, sand and gravel, silica refractories, glass sands, iron ores, lead and zinc, feldspar, underground water and soils. It has prepared, ready for publishing, a new geologic map of the state and has carried on geologic studies of the glacial deposits and stratigraphy.

It has published twenty-five reports totaling over 4000 printed pages, and now has ready for printing or nearing completion fully as many more. More than 1000 pages of mimeographed bulletins have been issued, and many articles prepared for the newspapers, or technical press.

With the advantage of the information gathered during the last ten years, the survey believes it is in a position to render a larger service during the coming ten years. It is a state service, giving free advice on any problem dealing with the earth, whether it is the underground water supply, or the possibility of mineral values under the old homestead; the origin of the will o' the wisp, earthquakes, or "the highest point within 50 miles of Philadelphia?"

General Building Construction With Slag Concrete

THE National Slag Association of Cleveland, Ohio, is publishing a series of symposiums describing the characteristics and uses of blast-furnace slag. Symposium No. 12, entitled "General Building Construction with Slag Concrete," quotes statements made by well-known authorities, articles from various engineering magazines, and technical papers, on this subject.

Slag Concrete Factories and Warehouses

The greater part of the symposium is devoted to the use of slag in the construction of concrete factories and warehouses. An impressive list of buildings is cited in which slag was used as one or all of the aggregates. These buildings range from one to nine stories in height and used varying amounts of slag aggregate up to 50,000 tons in each building.

W. S. Ferguson, Carey Construction Co., Cleveland, O., in the booklet "Slag" published by the Cleveland Furnace Co. in 1907, describes a building erected by his firm in that city, slag being used as the aggregate. A quotation, in which slag is the subject, follows:

"We have used this material in several structures throughout the country. We are very partial to this material and for all the buildings we design we do not consider any other material for the aggregate of our concrete mixture if slag can be obtained. We have found from laboratory tests and actual tests in the field that the resistance to compression is very much in excess of most broken stone mixes of the same proportions."

The Atlas Portland Cement Co. has been one of the largest users of blast-furnace slag. According to C. L. McKenzie, president, Duquesne Slag Products Co., Pittsburgh, Pa., 125,000 cu. yd. of slag concrete were used in the construction of the Northampton, Pa., plant. A. G. Croll, general superintendent of the cement company, is quoted as follows:

"Slag concrete was used by our company in its early days in building its plants at Northampton, Pa., about 1895. We have used many thousands of yards of slag in concrete work for very heavy foundations, such as for large engines and heavy grinding machinery. The slag concrete has proved entirely satisfactory and there has been no disintegration of the concrete."

Concrete construction in and around slag crushing and screening plants is always done with slag aggregate if possible although this is not always possible in the case of a new plant, due to the same conditions that make the construction of the plant necessary, lack of graded slag aggregate. The France Slag Co., in the construction of its new South Chicago plant, used slag concrete in its bins and other buildings. An article describing this plant, entitled "New Slag Crushing and Screening Plant," published in PIT AND QUARRY, Nov. 9, 1927, is quoted as follows:

"The Burrell Engineering & Construction Co. did an excellent piece of work in the design and erection of the concrete bins. Slag aggregate was used, providing another contribution toward greater strength."

The U. S. Bureau of Standards Report of Sept. 1921 gives a short history of the use of slag concrete in the United States:

"Blast furnace slag has been used as concrete aggregate for many years in all types of construction. The earlier use of slag for this purpose naturally developed in the furnace districts, where the problem of waste disposal was acute, and where conditions were such as to warrant a trial of the material for any purpose to which it might prove adapted.

"Accordingly, we find that slag concrete was used in the Birmingham district more than 30 years ago, first in plant and machinary foundations, and later for all kinds of concrete work. In the Lehigh district of Eastern Pennsylvania, records show that slag concrete was used by the Philadelphia & Reading R. R. in 1890, and by Atlas and other cement companies in 1895. In the Pittsburgh, Cleveland and Chicago districts also, the continuous use of slag concrete dates back to the early nineties.

"One of the earliest reinforced slag concrete buildings was erected in Philadelphia in 1897. When this building was torn down in 1913, both concrete and reinforcement were found to be in excellent condition. Railroad bridges and culverts have been built of slag concrete ever since the use of slag in reinforced concrete construction was first attempted."

Dr. J. E. Stead, metallurgical chemist, Middlesbrough, England, in an article, "Blast Furnace Slag in Concrete and Reinforced Concrete," published in *Engineering World*, Feb. 15 and March 15, 1919, says:

"The experience obtained in the Middlesbrough district over 50 years has established the fact that clean blast furnace slag as an aggregate in concrete is quite as good or better than gravel or limestone.

"Slag concrete in reinforced construction has been used in this district for many years; in no case has failure followed its use, and when it has been necessary to demolish such structures, the iron has been found to be intact and free from rust."

Slag concrete has also been extensively used in Germany in various forms of building construction. Dr. A. Guttman, director of research, Eisen Portland Cement Assn., Dusseldorf, Germany, is quoted as follows:

"In a period of 11 years there have been produced from German blast furnaces about 2,000,000 cu. m. (approx. 2,600,000 cu. yd.) of slag concrete. Foundations of buildings, bases for machinery, retaining and lining walls, conduits for water and gas, bridge piers, reservoirs and vaulted ceilings represent the principal uses of slag concrete."

Slag Concrete Hopper Bottoms

C. S. Wicker, sales manager, Buffalo Slag Co., in correspondence with the National Slag Assn., April 17, 1928, describes a novel use for granulated slag which has been developed in Buffalo, N. Y.

"All the grain elevators built in that period have hopper bottoms of 1:20 granulated slag concrete, over which is placed a layer of 1:3 mortar for a smooth finish. This furnishes a strong and economical floor which sets up like much richer concrete. On the occasion of making an opening in the floor of one of these bins (then 5 years old) the 1:20 concrete was found as strong and tough as the 1-2-4 concrete used for the walls. The cement storage silos of the Federal Portland Cement Co. at Buffalo are also equipped with this type of hopper bottom."

Slag Concrete in Railway Construction

Slag concrete has been used in railroad construction for many years for retaining walls, underpasses, bridges, culverts, etc. Philip Aylett, member, American Society of Civil Engineers, in an article, "Track Depression of Seaboard Air Line Railway at Birmingham, Ala.," published in *Engineering News Record*, Oct. 1, 1908, is quoted as follows:

"A noteworthy feature of the concrete work is the use of 'hot-pot' slag as the aggregate throughout. This slag is available in large quantities at the blast furnaces in Birmingham and vicinity. As no concrete work of any magnitude was known in which this slag had been used as the aggregate, unusual care was taken in mixing, etc.

"The concrete produced has proved to be of excellent quality. Tensile and compressive tests of specimens several years old, as well as examination of the concrete in the structures with chisel and drill, show the strength and durability to be entirely satisfactory, as is also the appearance of the concrete surfaces. The slag for foundations and for the body of the walls was broken to pass a 2-in. ring; for copings, railings, bridges and columns, ¾-in. slag was used. There is a total of 11,000 cu. yd. of concrete in the entire work."

Appendix D of the Report of the Masonry Committee, Bulletin of American Railway Engineering Ass'n. for Feb. 1918 quotes the following statements made by C. K. Lawrence, Chief Engineer, Central of Georgia R. R.:

"I have used slag concrete for 20 years. I introduced its use on this road when I became chief engineer about 11 years ago, and we have been using it to a large extent since that time. For heavy walls we have used considerable pit-run, screening the dust only. We have not used it as yet to any great extent in reinforced slag work, although I believe it will prove entirely satisfactory —in fact, I know from other reports that it has been satisfactory. It was used almost entirely in connection with the Macon Station, and has proved entirely satisfactory. I have never known a failure, and we find that wherever we are obliged to cut into a wall of slag aggregate that it is harder than any other concrete. We have used it to a large extent in practically all kinds of concrete work."

Miscellaneous Slag Concrete Construction

The symposium also cites a list of hundreds of buildings which have been built of slag concrete. These include packing houses, stores, office buildings, banks, schools, colleges, churches, hotels, apartment buildings, public buildings, hospitals, public garages and other miscellaneous structures. These include buildings of from 1 to 20 stories using from 700 tons to 30,000 tons of slag in each building. Included are such well-known buildings as the Hollenden Hotel, the Museum of Art, and the City Hall, Cleveland, O.; the Alabama Theatre and the Bankhead Hotel, Birmingham, Ala.; the Atlanta-Biltmore Hotel, Atlanta, Ga.; and the Drake Hotel, Chicago, Ill.

Slag Concrete Houses

Slag concrete houses have been built by assembling precast units and by pouring the structure in place. C. D. Gilbert in "Monolithic Houses at Donora for Steel Mill Operations," published in *Concrete*, January, 1917, described homes erected for its employees by the American Steel and Wire Co. at Donora, Pa. These were built to eight different designs for 4-, 5- and 6-room single and double houses. Portland cement, sand, and slag from ¾-in. down were used in their construction. The booklet "Blast Furnace Slag," published by the Carnegie Steel Co. in 1921, states that up to that time 100 such houses had been built at Donora.

One of the outstanding industrial housing developments using precast concrete is that of the Youngstown Sheet and Tube Co., at East Youngstown, O., comprising 281 homes. Units weighing from ½ to 6 tons were used. The concrete was mixed at a central plant and the mix consisted of one part cement, two parts sand and four parts

slag. This development was described by Harvey Whipple in "281 Fireproof Dwellings Built of Large Precast Concrete Units," published in *Concrete,* January, 1919.

The largest single group of concrete houses on record is that built at Liverpool, England, as part of the National Housing Scheme undertaken by the British Government shortly after the World War. This involved 6,000 houses built with precast slabs and blocks, using 250,000 tons of slag. An article, "Houses that Pushed Aside Cornsheaves," published in *British Builder,* Nov. 1920, is quoted as follows:

Dr. A. Guttman, in "Use of Slag in the Building Industries," published in 1919, cites a number of instances in which slag concrete was used in the construction of homes and apartment buildings in Germany and where slag sand was used in plaster.

Slag as a Concrete Aggregate

Many writers have also commented on the use of slag aggregate in concrete making without specifying the particular type of construction in which it was used. F. W. Taylor, mechanical engineer, and Sanford E. Thompson, consulting engineer, both of Boston, Mass., in their book "Concrete, Plain and Reinforced," published by John Wiley and Sons in 1916, make the following statement:

"Slag has proved a satisfactory coarse aggregate for concrete; slag has been used in important concrete structures in the blast furnace regions for many years, and its durability is well established for mass concrete provided a first-class quality is used. Tests indicate that a first-class slag may be expected to show strengths at least as high as limestone and gravel."

S. F. Wellman, president Wellman-Seaver-Morgan Co., Cleveland, O., in the booklet "Slag," published by the Cleveland Furnace Co. in 1907, says:

"I have been using blast furnace slag for concrete for ten or twelve years. My experience with it has been very satisfactory and I consider it by all odds superior to stone for that purpose. It makes a stronger concrete, and where saving in weight is desired, has that added advantage."

Ready-Mixed Concrete

The use of slag as an aggregate in ready-mixed concrete is also described. W. E. Barker, Highways Bureau, Portland Cement Association, in an article, "Ready Mixed Concrete Easily Sold in Birmingham, Ala.," published in *Engineering News Record,* Feb. 18, 1926, said:

"In Birmingham, Ala., the Sloss-Sheffield Steel and Iron Co. is selling ready-mixed concrete to anyone who knows enough about concrete work to use its product intelligently. The steel company built the plant because slag, a by-product of steel manufacture, could be used as aggregate. Sales have increased rapidly in the few months the ready-mixed concrete has been on sale.

"The mixing plant is built along a paved street, where it is readily accessible both to trucks and to the street railway company. It is near the slag pit, which is connected with a crushing and screening plant which prepares slag for the local material market. New slag comes to the pit daily.

"The slag is the product of the acid process of steel manufacture. It is air-cooled, and is mined by a steam shovel. Often it is necessary to blast the harder parts of the pit to break up the material so that the shovel can handle it.

"Every yard of concrete sent from the mixing plant is approved by an inspector, two of whom are on duty whenever the mixers are running. One inspector is supplied by the Southern Testing Laboratory of Birmingham. The Pittsburgh Testing Laboratory furnishes the other inspector. For this inspection service there is a charge of 5c a yard, which is paid directly to the laboratory by the purchaser.—"Concrete has been successfully hauled to Bessemer, a distance of 18 miles, without any noticeable segregation. The slag aggregate weighs 80 lb. per cu. ft. and does not settle to the bottom of the load as heavier aggregates might do on such a long haul."

A later article entitled "Ready Mixed Concrete from Birmingham Plant Finds Increasing Market," published in *Engineering News Record,* May 12, 1927, shows that production during 1926 was far above that in 1925. Incidentally, a maximum haul of 37 miles obtained in that year.

Summary

The American tonnages totalled from the previous pages give a figure of 2,379,000 tons of slag used in concrete building construction but this represents only about half of what has been actually used, and probably approximates what has been used by the American steel companies alone in their factory and mill construction.

The American Railway Engineering Association, through its masonry committee, as a result of twenty-five years' experience and observation of slag concrete, published the following report in its Feb. 1928 bulletin. This report succinctly sums up the general opinion of the use of slag in concrete building construction:

"The extensive use of slag concrete over a period of years has demonstrated its permanence for buildings, retaining walls, bridges, and foundation work where the structure is exposed to ordinary conditions. The strength of concrete in which selected slag is used as the coarse aggregate is equal to that of a concrete made of stone if an equal amount of cement is used per volume of concrete."

Sand and Gravel and Central-Mixing Plants Combined by South Bend Company

Geo. J. Hoffman and Company Supply Concrete For Paving and Building Work

THAT concrete central-mixing plants can be best operated in connection with a sand and gravel plant, provided that the plant be centrally located, is clearly demonstrated by the operations of Geo. J. Hoffman and Company at South Bend, Ind., a rapidly growing city of over 120,000 people. The central-mixing plant has a capacity of 600 cu. yd. per day and the sand and gravel plant about 800 cu. yd. per day. The location is about 2 miles west of the business center of South Bend.

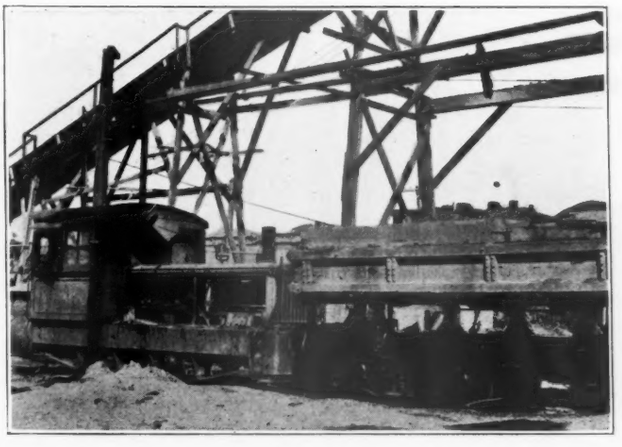
The original sand and gravel plant, which was built in 1915, was of Stephens-Adamson design. Part of this plant is still in use, including the scalping screen and the primary crusher. The newer part of the plant, including bins and sand classifiers, was designed by Geo. J. Hoffman, president of the company. All foundations are of concrete and the superstructure of timber.

The original central-mixing plant was built 3 years ago. A 1-cu. yd. Marsh-Capron mixer was used. The entire mixing plant was rebuilt last winter and a Smith 2-cu. yd. mixer added. Both mixers have Johnson weighing batchers. Plans are to install another 1-cu. yd. mixer this fall.

Pit Operations

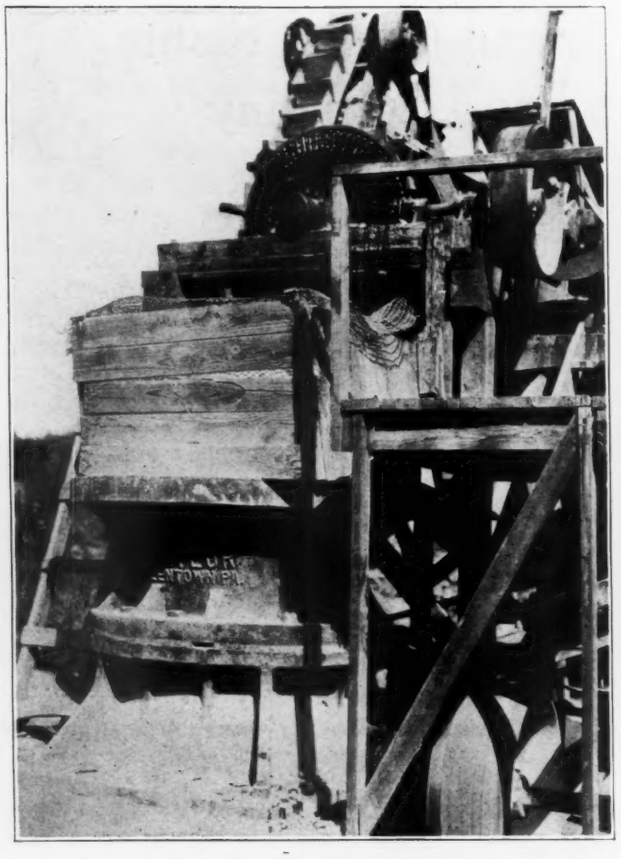
The property owned by the company consists of 103 acres, most of which is gravel. The overburden which runs from 2 to 4 ft. in thickness, was removed by an Erie ¾-cu. yd. steam shovel when the plant first went into operation. This same shovel was used to excavate the gravel to a depth of from 10 to 20 ft. over a number of years. Since the present dragline was installed to excavate to a greater depth than was possible with the shovel, the shovel has been kept in reserve for an emergency. The deposit averages about 50 per cent sand and 50 per cent gravel.

The dragline is a Page Class 220 rail type, with a Page 110-hp. diesel engine, an 85-ft. boom and a Page 3-cu. yd. bucket. It is working to a depth

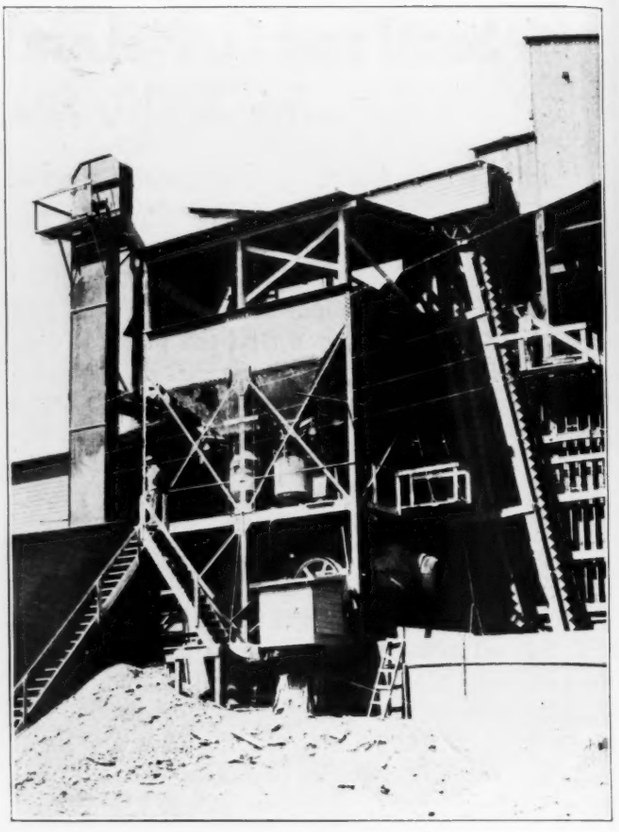


Gasoline locomotive hauling car of pea gravel at plant

Plant view from northeast. Office and storeroom in foreground. Cement storehouse and central-mixing plant at left, cars discharging to primary crusher at right



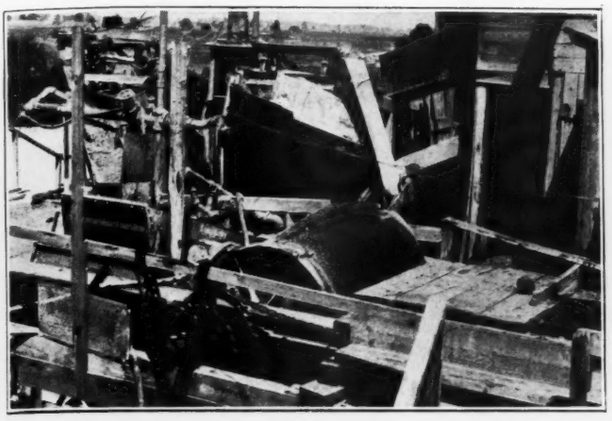
Primary crusher, scalping screen and elevator



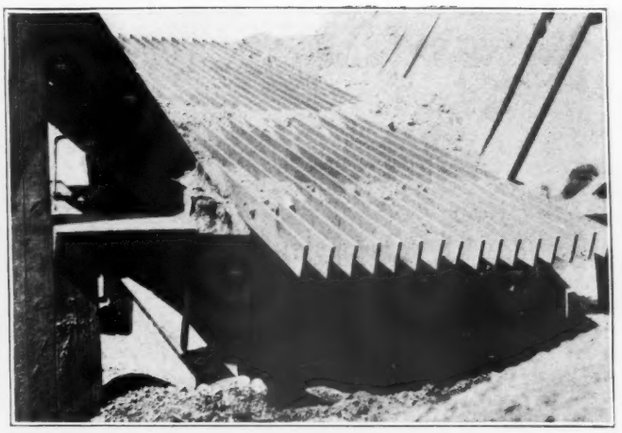
Concrete central-mixing plant with cement elevator at left and sand and gravel elevator at right

of 40 ft. and could go deeper if necessary. It loads into a 60-cu. yd. capacity Johnston steel hopper with a bar-and-rail grizzly to reject all stone over 14-in. An installation has been made by means of which small pea gravel, of which there is an excess in the deposit, can be removed when desired. The dragline discharges onto a sloping 2-in. bar grizzly, the rejects going onto the grizzly over the hopper. The material passing through the bar grizzly drops onto a double-deck Simplicity vibrating screen. The material passing the upper deck and retained on the lower—pea gravel—is wasted. That retained on the upper deck goes into the hopper, while the sand passing

Dragline in pit loading to field hopper. Locomotive hauling train of gravel to plant



Conical and vibrating sizing screens with sand classifiers in background

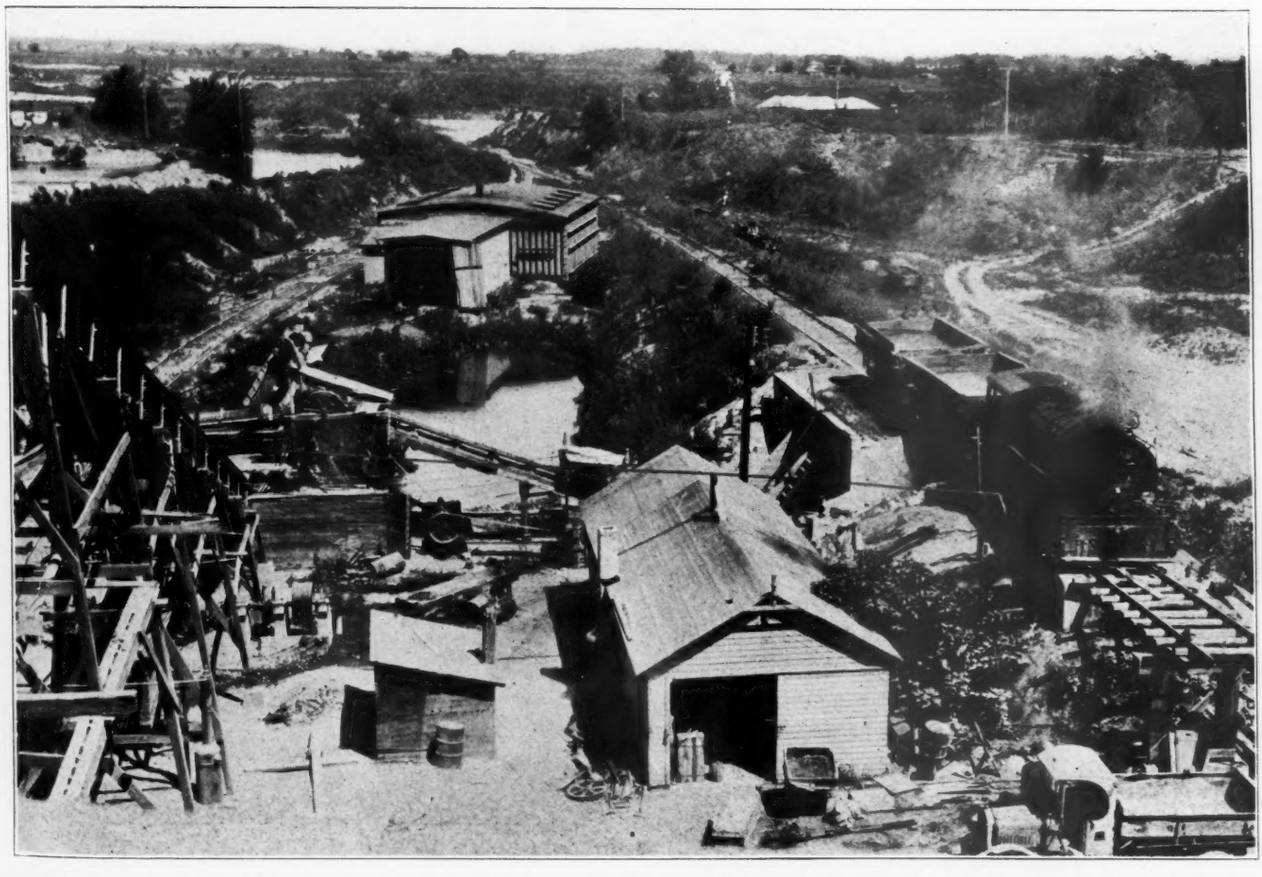


Bar grizzly and vibrating screen over field hopper for taking out excess fine material

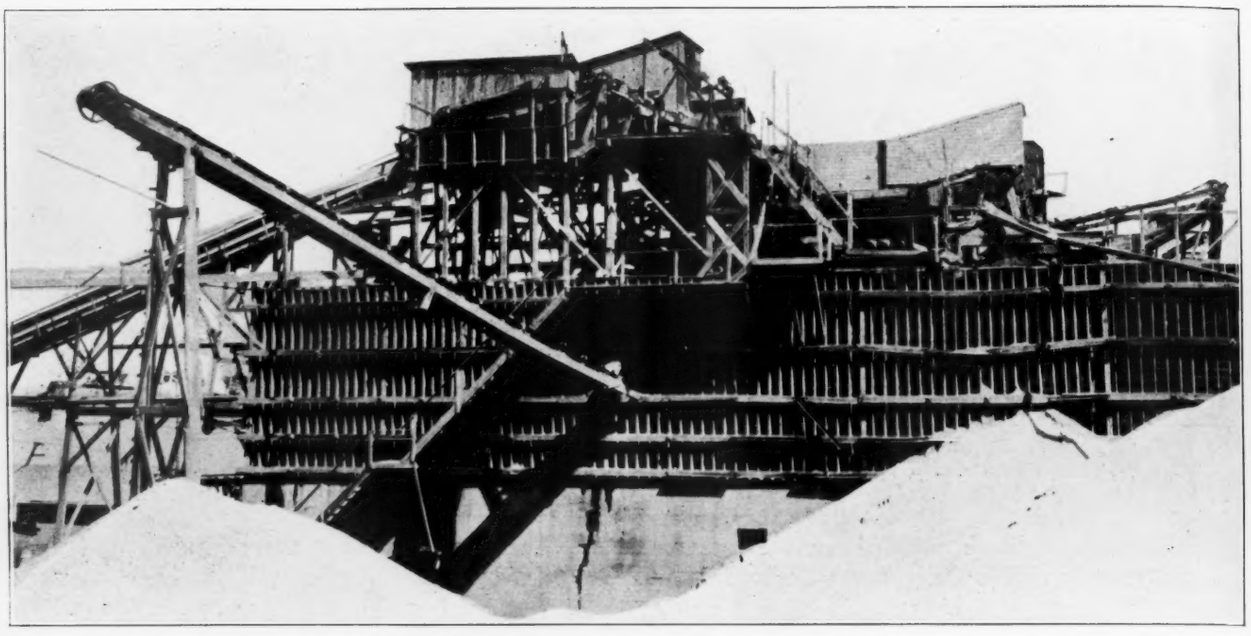
through the lower deck goes into a separate small compartment, from which it can be loaded into cars. The gravel discharges from the hopper through three segmental-type gates into 12-cu. yd. Western side-dump cars which are hauled, in trains of two, a distance of about 1,500 ft. to the plant. The hauling is done by a Plymouth 20-ton gasoline locomotive and a Porter 40-ton steam locomotive, the latter being used also for heavy switching.

Plant Operations

The cars are hauled up an incline at the plant and discharged into a concrete track-hopper with a 10-in. bar-and-rail grizzly. The oversize stones are pounded through with a sledge hammer. The hopper feeds, by means of a Stephens-Adamson pan-feeder, onto a short, inclined belt conveyor. This discharges into a Stephens-Adamson revolving scalping screen with 2¼-in. perforations. The oversize drops into a Traylor Bulldog 12-in. gyratory crusher which discharges into a concrete pit from which the material is elevated back into the screen. The material passing through the screen goes by a covered inclined belt conveyor to the screening plant. The short conveyor, feeder,



View from top of plant toward pit. Train discharging load of gravel at right, scalping screen and crusher at left



Plant from west, showing stockpiling conveyor and arrangement of screens and classifiers

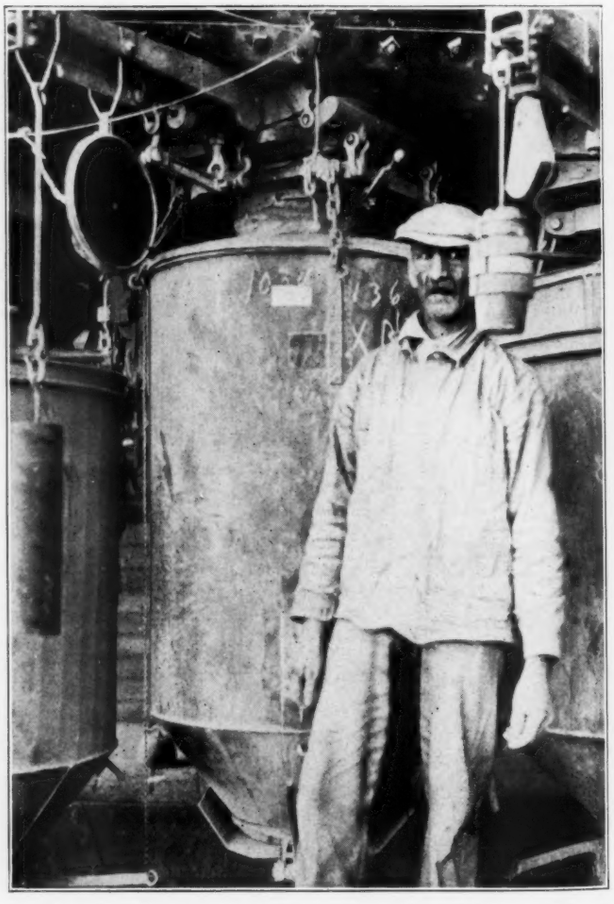
screen and elevator are all driven by the same General Electric motor, and the crusher is belt-driven by a 30-hp. Westinghouse motor. The crusher has a wire screen over the top to prevent crushed fragments from flying out.

The conveyor discharges through a steel chute to a zigzag steel trough where the material is rinsed by a jet of water. The trough discharges into two settling tanks which dispose of the dirty water. The tanks discharge respectively into a Stephens-Adamson Gilbert conical screen and a Simplicity 3-deck vibrating screen, clean water being added. The 1-in. to 2½-in., ⅜-in. to 1-in., and 3/16 to ⅜-in. sizes go through chutes directly into bins, while the 3/16-in. and finer goes into a steel chute with perforations in the bottom so that some of the fine sand can be cut out when desired. This chute discharges into two sand separating tanks of own design which use Link-Belt chains and paddles. When the sand from the pit is running coarse, the perforations are covered and only the first of the two tanks is used.

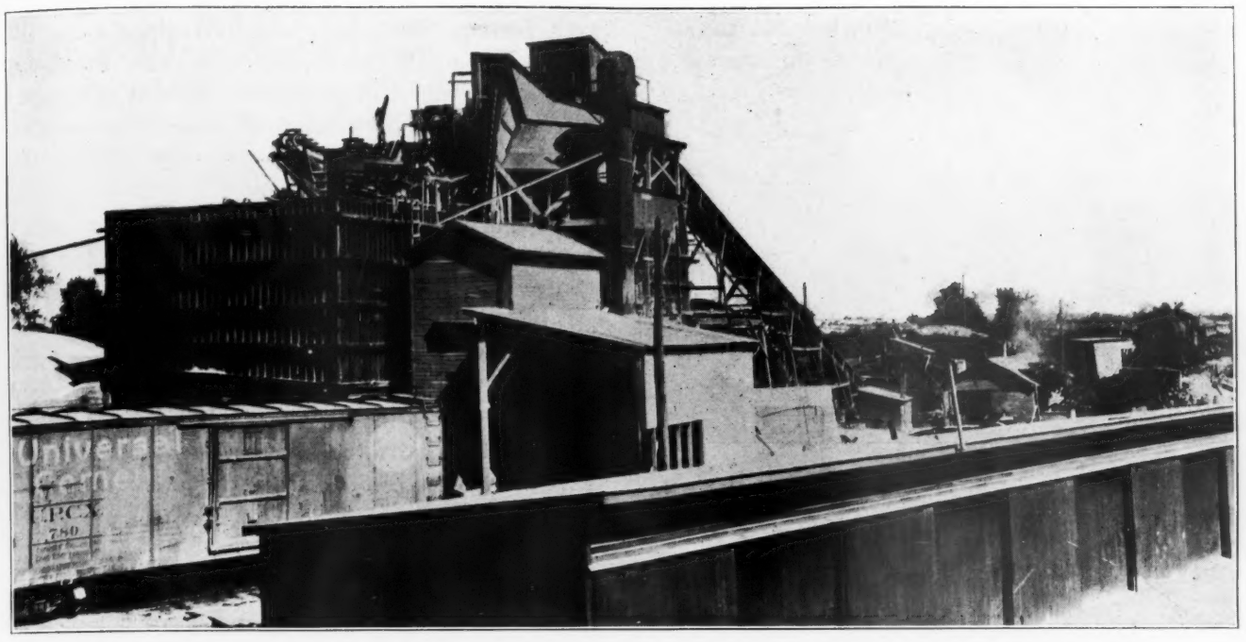
The five wooden bins, two for sand and three for gravel, have a total capacity of 2,000 cu. yd. When the bins are full, the sand is carried to a stockpile through a spiral steel pipe and the gravel by a belt conveyor. The wash water is carried away in a wooden flume. Material is rehandled from the stockpiles by an Erie crane with a ¾-yd. bucket. There are two tunnels under the bins, one for loading trucks and the other for cars or trucks. Two batch hoppers under the bins, movable to one side when not needed, allow loading into batcher trucks. Drain pans under the gates keep water from dripping onto the trucks.

The Central Mixing Plant

The arrangement is such that concrete sand and either ¼-in. to 1-in. or ¼-in. to 2-in. gravel can be used in the mixing plant. These sizes discharge from their bins through chutes to a Weller belt-



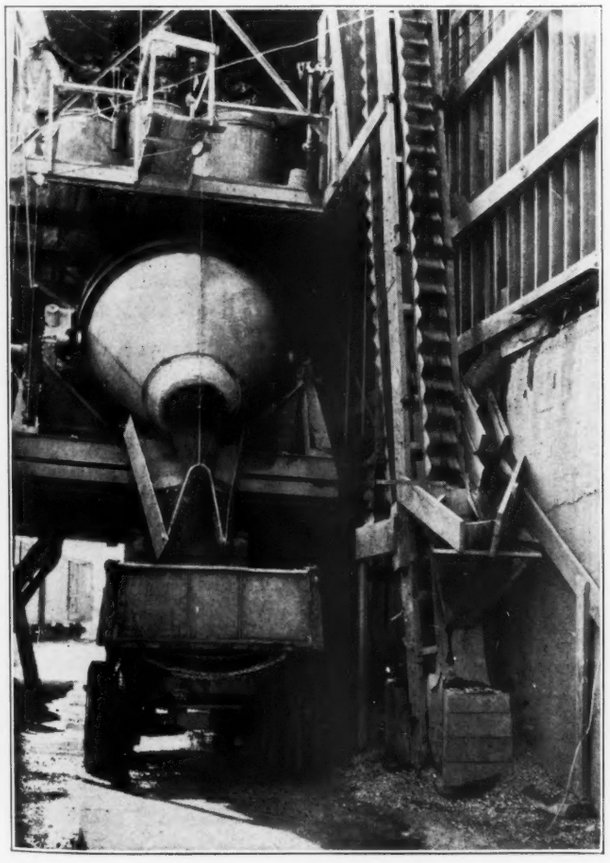
Weighing batchers for cement, sand and gravel for large mixer



Plant from southeast. Garage and cement storehouse in foreground. Track hopper for gravel at right

bucket elevator, which feeds through a split chute to any one of four compartments in the 125-ton capacity steel bin over the mixing plant.

Cement is purchased in bulk, in box cars, and is discharged by a Weller automatic scraper into a screw conveyor feeding an enclosed bucket elevator which, in turn, feeds the cement to the fourth compartment of the bin, which has a capacity of 65 bbl. When the compartment is full, the cement can be spouted from the elevator into a 900-bbl. capacity wooden storage house. When the bin over the mixer is empty and there are no cars to be unloaded, cement is drawn from the storehouse into the same screw conveyor and elevator to the bin. When both mixers are operating at capacity, however, all cement is loaded direct from the cars as needed.

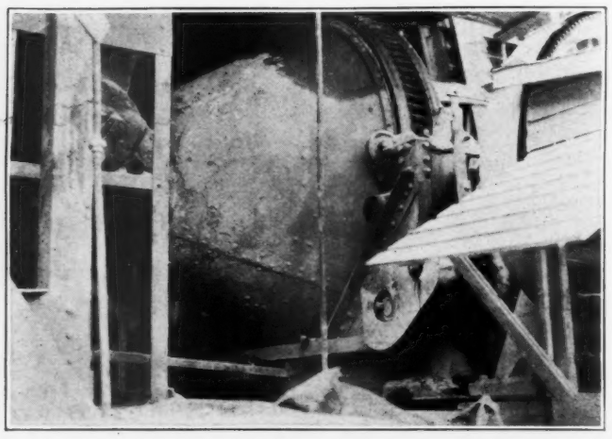


Two-cu. yd. mixer discharging into truck. Sand and gravel elevator at right, batchers above

The various materials are discharged by gravity from the bin into Johnson batchers over the mixers, the cement being agitated by air jets. Each mixer has three of these batchers, for sand, gravel, and cement respectively, each being equipped with Johnson hopper scales. These operate efficiently, only a few seconds being required to proportion a batch and discharge it into the mixer.

Water is measured in tanks of own design. These have a water-glass on the outside, with markings to show the amount of water taken from the tanks. The outlet pipe projects upward into the tank and can be set for any quantity desired by moving it up or down. The outlet valve when opened shuts off the inlet valve so that the entire operation is automatic. The water content is carefully watched, as the sand from the bins is usually very wet. Each mixer is controlled by a Koehring batchmeter which is set at 2 min.

The 2-cu. yd. Smith mixer is gear-driven by a 40-hp. General Electric motor and the 1-cu. yd. Marsh-Capron mixer by a 20-hp. motor of the same make. Trucks are loaded under the mixers in a tunnel, one side of which is formed by the gravel plant, the roof by the mixing plant, and the other side by a concrete wall. Air for agitating the



Closeup of 2-cu. yd. mixer with drive at right

cement is furnished by a small single-cylinder Gardner-Denver compressor.

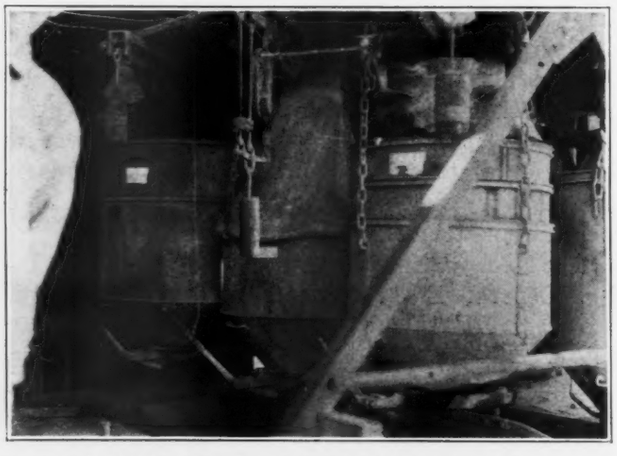
Distribution

All trucks for hauling sand and gravel and concrete are hired. These are all steel-bodied dump trucks. Concrete is delivered to points as far away as 16 miles, most of it being used for paving driveways and sidewalks. Last year over 6,000 cu. yd. were sold for track elevation work and a new depot to the New York Central lines. About one-half the output of the sand and gravel plant is delivered by truck, and the remainder is shipped over the South Shore electric railway for roadwork in the vicinity.

A concrete pipe company whose plant adjoins the company's property is furnished with aggregate for making small pipe and with concrete for the larger ones. The concrete is hauled in trucks and the aggregate switched direct from the plant in the pit-cars.

Miscellaneous

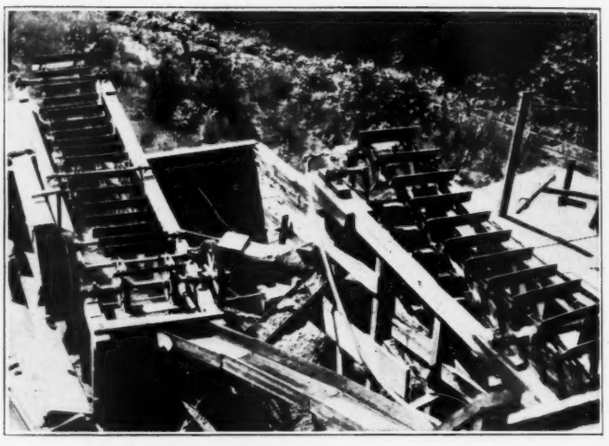
Wash water for the plant is furnished by two wells in an abandoned section of the gravel pit. Each is 58 ft. below the 25-ft. level. Two Union Steam Pump Company 5-in. centrifugal pumps each furnish 750 g.p.m. which is piped from the pit to the plant. All conveyors are Stephens-Adamson with United States Rubber Company belting, and the drive belts are Manhattan Condor. Johnson bins and batchers are used throughout the concrete plant.



Weighing batchers for the 1-cu. yd. mixer

Another plant owned by the company, which went into operation in 1914, is used for the production of fine sand. This plant is only ¾ mile east of the business center of South Bend.

One of the important reasons for the firm foundation on which the business of the mixing plant has been built is the iron-clad policy of not selling any concrete that is below standard. No concrete will be sold which has a slump of more than 7 in., and no contractor will be sold concrete for a job unless it meets the specifications for the job.



Two of the paddle-type sand boxes

Officers

Officers of Geo. J. Hoffman and Company are: Geo. J. Hoffman, president; Herbert H. Hoffman, vice-president; John Kuert, production manager; and H. E. Boyer, secretary and treasurer. Wm. H. Sousely is superintendent.

The mixing plant is owned by a separate corporation called the Kuert Concrete Company. John Kuert is president and general manager, and the stockholders are practically the same as those of the sand and gravel company. Sand and gravel are bought from the parent company.

Corking Paper

We have received the following note from one of our regular readers:

"Just taking a few minutes from regular routine to compliment you on the corking paper you have developed in combining PIT AND QUARRY with *Cement Mill and Quarry*. This is one of the finest trade papers we have had occasion to see for some time."

Deposits and Practices in the Land-Pebble Phosphate District of Florida

Stripping Is With Draglines and Ore Is Hydraulicked

By J. R. CUDWORTH
School of Mines, University of Alabama

[*In the following article, the author describes the geology of one type of phosphate mineral resource which supplies the bulk of the commercial demand by the manufacturers of fertilizers. He also explains the practices of stripping with draglines and of open-pit excavation of the valuable mineral by water under pressure.—Editor.*]

OF THE various mineral industries of Florida, the mining of phosphate rock ranks first in importance. Since the first commercial production of phosphate rock in 1888, from the Peace Creek pebble deposits, there has been a fluctuating but continuous production which amounted, in 1927, to 2,637,420 long tons with a value of $8,646,162. Ninety per cent of this production came from the so-called pebble district and the remainder from the hard-rock district which was described in the November 20 issue of PIT AND QUARRY.

Although the land-pebble district includes sections of Manatee, DeSoto, Hillsboro, and Polk Counties, most of the minable ore occurs in the last two counties only in an area of approximately 600 square miles. The nature of the ore is such that the amount and quality vary widely even in adjacent deposits.

The price of phosphate ore varies with the content of bone phosphate of lime. The market demands that the iron and alumina content must be kept below a certain limit, usually below 4 per cent. For this reason there are three grades of ore produced in the district: high-grade pebble ore, containing 74 to 80 per cent bone phosphate of lime; medium-grade ore, containing 70 to 74 per cent, and low-grade pebble, containing 66 to 70 per cent.

Recently, for special purposes, phosphate rock analyzing less than 66 per cent bone phosphate of

Typical layout of hydraulic equipment in land-pebble district

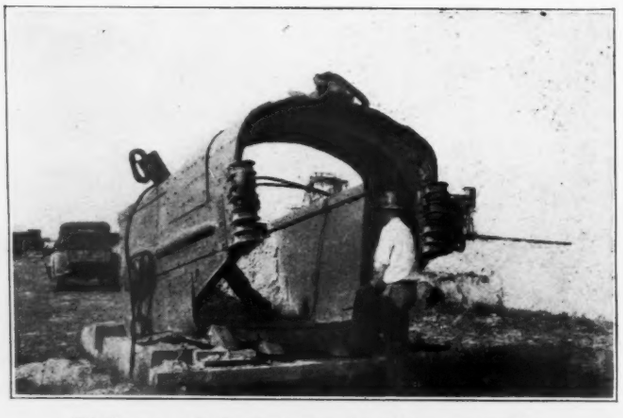
General view of a typical land-pebble pit

Hydraulicking land-pebble phosphate matrix near Brewster, Fla.

lime has been utilized to some extent. Indications are that, in the future, increasing amounts of low-grade phosphate rock will be substituted for some of the higher grades now customarily demanded by the trade.

At the present time, there are seven large companies reporting operations in the district. These companies operate mines, washing plants, and drying plants, and some of them generate part or all of their power requirements in the various operations. Formerly, all of the phosphate companies operated railroads connecting their mines and washeries with the drying plants, but some of the companies now have their washed products hauled to the drying plants by either the Seaboard Air Line or the Atlantic Coast Line, both of which serve the district. These same railroads haul the finished product—dried phosphate rock from the dry-storage bins of the various plants—to their trans-shipping facilities at Port Tampa and Boca Grande, where the ore is loaded into steamers for coastwise and foreign shipment. The loading docks of the railroads are most efficient in their operation.

The products of the land-pebble district are predominately used in the manufacture of acid phosphate or super-phosphate for fertilizers. Some phosphate is sold for chemical purposes. Near Tampa, Fla., one super-phosphate plant has been in operation for several years, and its capacity is being enlarged, while a second plant is under construction.



Eight-cu. yd. bucket for dragline excavation

The land-pebble deposits occur as beds or pockets, varying laterally and vertically in thickness. A phosphate bed is composed of a matrix of clay, sand, and soft phosphate, in which are embedded phosphate pebbles and, more rarely, bones of both marine and land animals. The theory as to the origin of the deposits is somewhat complicated, for it is evident that many mechanical and chemical processes played a part in the deposition. The bed-rock is a phosphate marl, for which the ore is believed to have been derived by a redeposition and concentration by advancing and receding seas.

The overburden consists mainly of loose or weakly coherent sands, some boulders, and clays. The phosphate beds vary from 10 ft. to 35 ft. or more in thickness and the overburden from 5 ft to 50 ft.

The phosphate content of the ore beds varies widely over comparatively small areas. The areas containing minable ore are not continuous, hence careful prospecting is necessary before development. Prospecting is done with hand augers where the overburden is shallow and free from boulders. The usual practice, however, is to use well drills, locating the holes at regular intervals. With a few holes placed, in the first step, information is obtained as to depth of cover, thickness of the phosphate bed, and quantity of phosphate pebbles. If the results of the first drilling are promising, more holes are put down at closer intervals.

Stripping Operations

In the early history of the district the overburden was removed by scrapers and steam shovels, using the customary stripping practice, with steam locomotives and dump cars for transporting the material from the cut. Later, hydraulic mining was introduced into the district and was applied both for the stripping of the overburden and for mining the matrix. This practice required less expenditure for equipment, but it could not be used in all locations. Blasting was sometimes necessary where boulders and hard-pan were found.

Stripping with dragline in land-pebble district

Removing overburden by dragline and hydraulicking phosphate matrix

The most recent method of removing overburden is with dragline excavators, which entered the district about 1921. The use of dragline excavators has become increasingly popular until it is almost universally practiced at present. Apparently, these excavators have proved successful at a lower cost than the steam shovel. The drags, as they are called, are all electrically operated and are mounted on caterpillar treads or on "mats" (timbers mounted on tracks). The booms vary in length from 135 ft. to 165 ft., with 6-cu. yd. to 8-cu. yd. buckets. Although both direct current and alternating current are used for draglines in the district, the first type is favored, as the electric load is more uniform.

The amount of overburden handled in a day by these draglines is great. One electrically operated dragline, with a 125-ft. boom and an 8-cu. yd. bucket, is capable of handling over 400 tons of overburden per hour where the banks are up to 30 ft. high. This particular dragline utilizes direct-current motors of 475 hp. and is mounted on caterpillar treads.

Where dragline excavators are used, the two operations of stripping overburden and hydraulicking the phosphate matrix are carried on simultaneously in the same pit. The overburden is dumped back into the cut after the matrix has been removed.

Excavating the Matrix

The universal practice of removing the phosphate matrix in the district is by hydraulic mining methods, which have the advantage of partially disintegrating the matrix during the operations. The primary source of the water is deep artesian wells, which supply is supplemented by rain water and seepage. All of the companies, however, have elaborate circulating systems consisting of settling ponds and abandoned pits which return the water used in all washing operations, after clarifying, to the pumps. The same procedure is followed for hydraulicking either the overburden or the matrix.

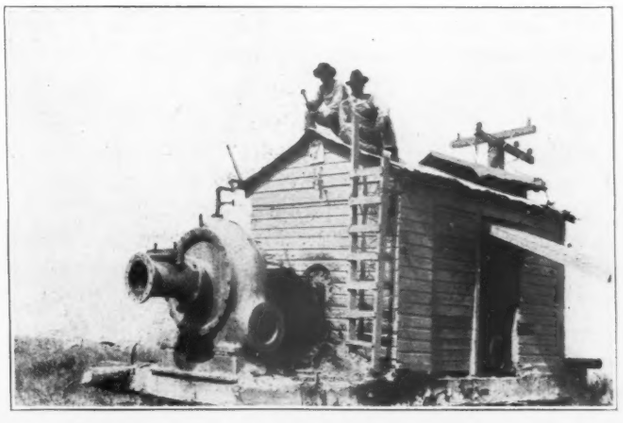
A sump is sunk through the matrix to the bedrock beneath. The matrix bank is disintegrated and washed into this sump through ditches by hydraulic giants operating at about 200-lb. pressure and with a 1½-in. to 2-in. nozzle. The technique of directing these giants, which are hand-operated, provides a practically constant flow of disintegrated matrix and water to the sump.

From this sump the material is sucked up by a 10-in. or 12-in. centrifugal sand-pump to the washer. The suction pipe in the sump is suspended from a tripod derrick which allows it to be raised when the pump becomes clogged.

The pumping units themselves are interesting. They are driven by direct-connected electric motors. The motors are housed by frame sheds but the pumps are exposed. Each whole unit is mounted on skids, which allows easy transportation. These pumps are capable of handling up to 6,000 gallons of pulp, containing 8 per cent to 10 per cent solids, per minute. They are built to stand heavy duty and to handle material which is very abrasive. The wear on pump parts is heavy, and maintenance charges are high.

When the washers are located a considerable distance from the pit, it is necessary to supplement these pumping units with booster pumps of similar design. The pipes used in the hydraulicking operation are spiral-riveted for the water lines. For

(*Continued on page* 82)



Pumping units are mounted in this fashion to be portable

Finding the Right Person for the Job by Job Analysis

BY WALDO HUTCHINSON

IT HAS become more and more willingly admitted within the past few years that there is such a thing as fitting the right worker into the right place; and that a man in one instance appearing to be a square peg in a round hole will prove to be the round peg, if he is put on the right type of work.

To transfer workers within a plant intelligently so that their ability may be utilized to the best advantages (not only for the company but also for themselves) it would seem that again the need of some definite knowledge of the job and worker arises.

If in the greater number of cases, wages, transfers and promotions could be made on the basis of accurate information, would there not be much less chance for dissatisfied workers in an organization?

Going further, it is found that without particular intent on any one's part some one worker or group of workers forces the rates of pay for their work to a level out of all proportion to other jobs within the plant. In some cases, this may have been possibly due to certain economic conditions at the time, but in many instances it is due to the insistence of certain workers for raises which, if not checked and compared with the actual worth of the job to the company and of similar jobs, will in a short time raise havoc with any equitable wage scale which might have been based on the best intentions.

Especially valuable to the plant engaged in operating a training school of some kind is the knowledge of just for which jobs to institute a training school. This includes information concerning the experience, qualifications and best types of persons to break in on jobs.

In this work of making an analysis of jobs, it is felt that the subject should not be approached from too scientific a point of view. It must be realized that labor has been and always will be the one intangible thing necessary to business which cannot be accurately measured. While material can have certain dimensions, specifications and chemical analysis which can be most accurately determined, labor is an element which cannot be analyzed or standardized beyond a certain point. Therefore, it seems impracticable for the average plant to attempt to go to the last degree in this work.

It is always advisable to take your foreman into your confidence when doing work of this nature, or for that matter, work of any kind which affects past custom or practice. You will be surprised to what a large extent your foreman will be with you in this; for as a rule, he more or less hates to be obliged to hire, fire and discipline people. Furthermore, each foreman always feels that the jobs in departments other than his own are easier and worth less, yet are valued higher by the management, which has never made any attempt to equalize rates for the various classes of work. Many times the writer had had expressed to him from various shop men the fact that they would be mighty glad to be relieved of having to continually pass judgment on this man or that man who asks for a raise. And again, experience has proved that the foreman is not in a position to give a raise to this or that worker or a group of workers on his own judgment, and at the same time maintain any degree of uniformity in the wage scale of his department or of the plant.

Getting right down to the work involved in making an analysis of the jobs in any plant and putting the information secured in usable shape, it has been found that there are four major steps:

1—Determination of the elements to be gone into for each job and the analysis of the various jobs throughout the plant.

2—Determination as to just what constitutes the vital elements of the job and the important points to be observed in the type of worker required. Such specifications should then be recorded in some usable form.

3—Grouping of all jobs into classes of a similar worth to the company, and establishment of rates of pay for these different classes.

4—Assignment of the worker to the proper job and job class. Also the rearrangement, where necessary and practical, of the worker's rate of pay.

The work involved in the first phase of the work—that of making the analysis—is the first to be considered. Forethought must be given as to what points are to be analyzed. It must be distinctly understood just what is meant by the word "job." Probably a proper definition of the word would be "that portion of work or an operation which it is most economical to perform by one operative at one time." Having determined just what elements of the work and just what characteristics of the worker should be observed, it is necessary to begin the collection of data required. In most cases, this is probably best accomplished by the making out of a sheet for each job, so that after the information is secured, these sheets can be sorted and resorted, as desired. Remember that the information being sought can only be secured in the shop. Therefore, it is vitally important that this work should not be carried on in an office. The person assigned to the making of the analysis should get right out in the shop with the foreman, his assistants, and even the workers themselves.

Naturally, the nature of the work in question determines to a large extent just what must be looked for, but in any event, information must be secured from two angles:

1—The job or work itself.
2—The type of worker required for the job.

As to the job itself, let us first make sure that we have a full description as to just what the job is. Consider the name or title by which this operation or work is known, and be sure that it is inclusive of all things done on this job. Many times it has been found that the present shop name of the job is very misleading when the actual work performed is observed. The points generally to be considered are:

1—Number of people on this work at present segregated as to male and female. This fact is of value as it shows the importance from a labor-capacity viewpoint of this job to the entire department or plant. Furthermore, the fact of having both males and females on the same job is something which should be studied, since most jobs are more adapted to one particular sex than to the other.

3—Previous experience required for this work, together with experience known to be absolutely necessary, will be found to be a great aid in analyzing the past experience of the best and also of several average workers on the job. Frequently, it is found that there has been some previous experience on the part of these workers which has been especially helpful to them in their present work.

3—If there are both male and female workers on the same job, it should be found out which are the most efficient.

4—The age at which a worker can best start at this work is important.

5—Aid in determining the length of time to become an average worker will be found from the records showing the length of time the average worker has been employed on this particular task or job.

6—Such facts as whether the job is clean or dirty, dry, dusty, or wet, have a bearing on the desirability of the job from a worker's standpoint.

7—Some work of a repetitive nature will be found to be best accomplished by a slow, phlegmatic type of worker, where other types of work will require a keen, quick, nervous person.

8—Information should be secured as to present rates, both hourly and piece-rate, and also average hourly earnings at piece rates.

9—Other information pertinent to certain types of work should be recorded and also any special rates not covered by the general headings.

Note should be made of any special conditions of the work which make it a job much sought after and considered a desirable companion. Consider also in detail these features of the work which makes it a job much sought after and considered a desirable occupation.

Consider also in detail those features of the work which make it very disagreeable as for instance, washing of work, plating room work, or that which is generally damp and more or less disagreeable in cold weather.

As to the worker, it is especially important to select the most efficient workers on each job and compare their qualifications with those of the average worker and see whereby the presence or absence of certain qualities has tended to aid in developing them. In the matter of defining exactly the type of man or woman required for the job, again remember that it is foolish to go to the very last notch in attempting to gather information and set up standards. Responsibility for the selection of efficient and desirable employes must be placed in your Employment Department. You cannot get away from the fact that in the selection of the right employment men, who understand your shop and who also can read human nature, a great amount of success in securing desirable employes lies.

The essential points which would ordinarily be considered as to the type of worker desired would be:

1—Male or female.
2—Past experience required.
3—Education required.
4—Best age to start.
5—Length of time required on this job before becoming average.
6—Length of time required on this job before becoming efficient.
7—A quick or phlegmatic type of worker.
8—Eyesight.
9—Condition of hands, fingers, etc.

We now come to the second major phase of the work, which is the determination of the vital elements in the job and the certain necessary qualifications on the part of the worker. This work should all be handled, preferably by some committee appointed for this purpose which would call upon various shopheads for its advice and opinion, as needed.

1—Clean or dirty work.
2—Automatic machine, semi-automatic machine, hand-operated machine. or bench work.
3—Standing or sitting.
4—Close work, eyeglass work, or work which is productive of eye-strain.
5—Light or heavy work.
6—Monotonous or interesting.
7—Number of machines operated.
8—Basis of wage payment.
9—Does operator control the quality of the work produced on the job?
10—Percentage of such control over quality.

Those points to be considered and determined as they relate to the worker are under the heading of Worker Specification:

1—Male or female.
2—Age limits.
3—Best age to start.
4—Approximate number persons for this work.
5—Previous experience required, and the amount of time of such previous experience.
6—Education required.
7—Time to learn.
8—Promotion from what job to this, and from this job to what other job.
9—Deliberate.
10—Thorough.
11—Slow.
12—Observant.
13—Patient.
14—Quick.
15—Active.
16—Good eyesight.
17—Tall.
18—Medium.
19—Short.
20—Right or left-handed.

Having recorded those points which actually determine the work and the worker required, such data should now be put in usable form for reference. Probably the best manner of keeping these data is to make out a small card for each job, and then file these job-cards by the various classes, as will be later set up, maintaining such file in the Employment Office with a duplicate file of those jobs affected in the office of the foreman, for his use. In some of the simpler types of industries, and especially in small plants, this information can possibly be placed on large sheets. Where convenient to do so, a better picture is thus presented for comparative purposes of the different jobs one against the other.

Up to this time, our problem has been one of analysis and determination applied to each individual job—which brings us to the third phase of the work where we are ready to consider grouping the various jobs into classes, and establishing of rates for each class. This is probably the most vital part of the whole plan, because we now come to the actual valuation of each job as compared with the others, and begin to assign the respective jobs to various classes. In the comparison of one job with another, it must be at all times borne in mind, that it is the work which is being compared and not the worker who may be on this job at the present time. In many cases, it has been found that the worker was doing work of a simple nature and yet was being paid a considerable amount of money for same.

Here again, it will be advisable to refer the observation to a committee which has power to call in various shopheads as needed. In making its decisions this committee must be guided at all times as to just how much each job is worth to the company. Thought must be given to the especial type of worker required for the job in question. The general ability of the worker needed for the work must be gone over, and care taken that the job is not over-rated as to the type of worker required. The length of time required to learn the work, and the special skill or dexterity which a worker must develop before becoming proficient on that particular type of work, are questions which in many plants are open to considerable argument. How much is the same worker worth to this company after having been put through a considerable period of training?

In many plants there are jobs of such special nature that it is a considerable loss to the company when a person who has received a long period of training at such work, leaves the company. Such a fact must be well considered. Then again, there are certain classes of work in which many plants are subject to more rapid labor turnover than others. It must be kept in mind that labor turnover costs money, and that while a certain job may seem to be worth comparatively little to the company, yet on account of a high rate of turnover on such work both in this and other plants, it may prove more economical to value this job higher than would otherwise be the case. Any especially attractive features of the work which makes it a job much sought after must be well debated, for they often make it possible for a plant to employ persons at a somewhat lower rate. Bank clerks might possibly be considered as an example of this type of work, where rather a high type of worker is needed, yet is secured at a minimum rate, due to the fact that many people consider this a very desirable sort of job. Any especially disagreeable kind of work, as for instance, stevedore work, or one that involves considerable amount of time spent in dusty rooms, damp rooms or out-of-doors in the winter time, is a type of job which allows a worker to demand considerably more money than the job may apparently seem to be worth.

Deposits and Practices

(*Continued from page* 79)

handling the pulp from the pits to the washers, 10-in. to 12-in. cast-iron pipe is used.

The sizes of the pits vary widely, although they average about 40 acres for all hydraulic operations. Where dragline excavators are used for removing overburden, the cuts are from 120 ft. to 200 ft. wide and up to 1,320 ft. long.

The author acknowledges the kindness of various operating officials who gave him permission to visit the properties and who furnished him much information as to operating practices. He is indebted also to Herman Gunter, state geologist, and to the publications of the Florida Geological Survey for aid and for certain photographs. Some of the information has been obtained from various articles published on the district by the U. S. Bureau of Mines and individuals.

The companies reporting operations in the district are: International Agricultural Corporation, American Agricultural Chemical Company, Southern Phosphate Corporation, Swift and Company, Coronet Phosphate Company, American Cyanamid Company, and Phosphate Mining Company.

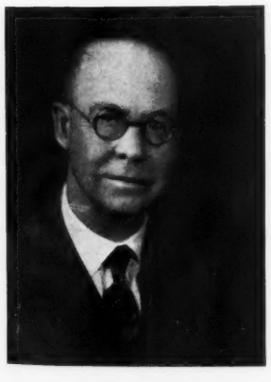
Century of Progress to Show Quarrying and Mining by Dynamic Exhibits of Operating Methods

Sand, Gravel, Stone, Cement, Gypsum, Lime and Cement Plants To Be Featured

IT IS NOT news, probably, to any of our readers that there is to be a great show at Chicago, in 1933; but it may be news to them that this great event has an intimate relationship to their mineral industry.

This demonstration of the city's century of progress since the year when Fort Dearborn was re-named Chicago is already occupying the earnest, full-time attention of many persons. The event is to be, not a world's fair, as that type of big exhibition has come to be known to the public, but a tremendous pageant built around the theme that civilization's remarkable advance during the past one hundred years is attributable to the fact that this century has been the world's first scientific age.

The board of trustees of this gigantic project has secured financial backing in ample proportions to warrant the immediate procedure of tangible construction work, and is assured of plenty more capital as needed. The Federal Government has given its sanction to the affair, and foreign nations have signified their intentions of hearty participation in displays and attendance. The trustees appealed, some time ago, to the National Research Council to assume the task of pictorializing the role that sciences have played in the past century. The Council accepted this challenge and quickly created what is known as the Science Advisory Committee to Chicago's Century of Progress, composed of prominent individuals who were nominated by each of the national scientific and engineering societies. It is seen, therefore, that science, especially applied science, is the keynote of the whole exhibition.



A. J. Hoskin

Various sub-committees have been named to cover each of the country's major industries. Our interest centers in that particular sub-committee which was first called the Committee on Mining Geology, Mining, and Metallurgy, but which is to be known hereafter as the Mineral Industries Committee. At the head of this big committee is Dr. M. M. Leighton, chief of the Geological Survey of Illinois, Urbana. At his invitation the following men held a two-days' meeting in Chicago, November 22 and 23, at the Chicago Engineers' Club and the Union League Club:

A. C. Callen, mining engineering department, University of Illinois, Urbana.

G. E. Ekblaw, State Geological Survey, Urbana, Ill.

Samuel Eppstein, Illinois Steel Co., Chicago.

John Garcia, Allen and Garcia, Chicago.

J. H. Hedges, assistant to director, U. S. Bureau of Mines, Washington, D. C.

J. H. Hedges

E. A. Holbrook, schools of engineering and mining, University of Pittsburgh, Pittsburgh, Pa.

A. J. Hoskin, PIT AND QUARRY, Chicago.

W. O. Hotchkiss, Michigan College of Technology, Houghton, Mich.

J. E. Lamar, State Geological Survey, Urbana, Ill.

E. T. Lednum, E. I. du Pont de Nemours & Co., Chicago.

H. W. Nichols, Field Museum, Chicago.

Heinrich Ries, Geology Department, Cornell University, Ithaca, N. Y.

W. A. Scheuch, Western Electric Co., Chicago.

Edward Steidle, School of Mining, Penn State College, State College, Pa.

Wilford Sykes, Inland Steel Co., Chicago; chairman Chicago section, American Institute of Mining and Metallurgical Engineers.

J. R. Van Pelt, Jr., geologist, Chicago.

H. T. Walsh, Sullivan Machinery Co., Chicago.

C. C. Whittier, Robt. W. Hunt Co., Chicago, and trustee Western Society of Engineers.

C. E. Williams, Batelle Memorial Foundation, Columbus, O.

L. E. Young, Pittsburgh Coal Co., Pittsburgh, Pa.

Acceptance of appointment on this committee by the editor of PIT AND QUARRY affords the opportunity of reporting the proceedings of this significant meeting.

Dr. Leighton presided at the several sessions. A number of prominent men who were unable to attend these sessions for good reasons will probably become active members of the committee.

Major L. R. Lohr, manager of The Century of Progress, made the first address after Dr. Leighton had carefully outlined the general purposes of the meeting. The manager set at rest any misgivings that might have been held by those in attendance as to the probable success of the gigantic enterprise. He stated that three words must apply to every exhibition: it must be unique, dynamic, romantic. This show is not to be a museum, an art gallery, nor a display of wares; but it will be a moving, brilliant, intriguing pageant. Things are to be moving. Goods are to be manufactured on the spot.

The members of the committee were thrilled, furthermore, when Major Lohr made it clear to them that the committee's function shall be to demonstrate that the territory known as the Chicago District has changed from a pioneer, frontier, agricultural community to a great metropolis primarily because of its many interests in the mineral industries. This same idea was emphasized later, at the evening dinner, by C. S. Peterson, Chicago's city treasurer and vice-president of the Century of Progress, who is credited with having first conceived this project.

Serious thoughts were expressed by all of the committee members, and every man seemed enthused and ready to push. On the second day, the committee separated into its various subordinate committees, each of which discussed plans and assigned duties to its individual members. In this manner, tangible beginnings were made by the respective committees on metal mining, coal mining, and non-metallic mining. This last-named subcommittee comprises J. H. Hedges as chairman; Max. A. Berns, Universal Portland Cement Co., Chicago (not present); J. E. Lamar; and A. J. Hoskin.

Max A. Berns

During the general sessions of the major committee, a tentative plan was made for the construction, on Chicago's water front, where land has been and is to be made, of a huge building simulating a rocky mountain within which and upon whose flanks will be portrayed the operations of quarrying and mining. The suggestion was offered by the non-metallic members that a sand-and-gravel dredge might be displayed operating in a lagoon at the foot of this structure, which was termed, for convenience, Whittier Mountain, in reference to the author of the idea.

Every member of each committee will prepare a personal report to his respective sub-chairman prior to December 10, 1929. Then each such sub-chairman will integrate these reports into his report to Dr. Leighton, who, in turn, will report directly to the Science Advisory Committee, which has the final decision as to what suggestions will become realities.

Dr. M. M. Leighton

The big affair will begin May 1 and will end November 1, 1933. Our readers may feel assured that the non-metallics mining sub-committee will do all within its power to activate many features in their special field. The committee will welcome suggestions, which may be submitted to any of its members.

Cement Safety Meetings Scheduled For 15 Cities Next Year

Fifteen regional safety meetings have been scheduled for next year by the Accident Prevention and Insurance Bureau of the Portland Cement Association. The locations of the meetings and the dates, together with the chairmen, where they have been chosen, are as follows:

Jan. 22, Birmingham, Ala.—H. O. Underhill, Chairman, Alpha Portland Cement Co.

Feb. 4, Dallas, Tex.—L. R. Ferguson, Chairman, Lone Star Cement Co., Texas.

Feb. 11, Cincinnati, O.—W. W. Hamilton, Chairman, Alpha Portland Cement Co.

Feb. 25, St. Louis, Mo.—Hiram Norcross, Chairman, Missouri Portland Cement Co.

March 4, La Salle, Ill.—(Chairman not selected.)

March 18, Des Moines, Ia.—W. H. Klein, Chairman, Pennsylvania-Dixie Cement Corp.

March 25, Kansas City, Mo.—R. M. Johnson, Chairman, Consolidated Cement Corp.

April 15, Albany, N. Y.—F. P. Monaghan, Chairman, Glens Falls Portland Cement Co.

May 29, Easton, Pa.—S. H. Harrison, Chairman, Vulcanite Portland Cement Co.

June 24, Cleveland, O.—W. L. White, Jr., Chairman, Medusa Portland Cement Co.

June 26, Washington, D. C.—John J. Porter, Chairman, North American Cement Corp.

July 1, Detroit, Mich.—H. T. Hutchins, Chairman, Wolverine Portland Cement Co.

Sept. 9, Seattle, Wash.—(Chairman not selected).

Sept. 16, San Francisco, Cal.—(Chairman not selected).

Sept. 23, Ogden, Utah—(Chairman not selected).

Portland Cement Association Holds Annual Meeting

THE Twenty-Seventh Annual Meeting of the Portland Cement Association was held at the Blackstone Hotel, Chicago, on November 18, 19 and 20. Standing committee meetings, annual business session, the election of officers for 1930, the appointment of President Frank H. Smith to confer with other business leaders and President Hoover, and the annual dinner were outstanding features of the session.

The opening session was held on Monday, November 18 with registration lists indicating attendance of 208 individuals from 52 member companies. Meetings of standing committees occupied the entire day and included sessions of the committees on Technical Problems, Advertising, Conservation, and Elimination of Waste in Selling, among others.

The Tuesday meeting was featured by the annual business session. It was during this period that a message from the Secretary of Commerce was read, inviting the Association to send a representative to confer with President Hoover. This resulted in the unanimous nomination of Frank H. Smith, president, to represent the cement industry at Washington.

Acting on the report of the nominating committee, members of the Association elected the following officers for the coming year: Frank H. Smith, Lawrence Portland Cement Company, president; Charles L. Hogan, International Cement Corp., first vice-president; Blaine S. Smith, Pennsylvania-Dixie Cement Corp., second vice-president. C. E. Ulrickson, Trinity Portland Cement Co., was elected treasurer by action of the board of directors. The following directors were chosen for a three-year term ending with the annual meeting of 1932: J. B. John, Medusa Portland Cement Co.; D. H. MacFarland, Atlas Portland Cement Co.; Charles Schmutz, Bessemer Portland Cement Co.; John L. Senior, Consolidated Cement Corp.; and F. E. Tyler, Dewey Portland Cement Co.

Frank H. Smith

The annual dinner was held Tuesday evening and was attended by 234 member officials and Association employes. Frederick A. Boeye officiated as

Charles L. Hogan

Blaine S. Smith

C. E. Ulrickson

J. B. John

toastmaster. Feature addresses were given by Walter A. Head, president of the State Bank of Chicago, who analyzed the causes leading up to the recent collapse of the stock market and the possible and probable consequences. He was followed by James Weber Linn, professor of English at the University of Chicago, who spoke on the importance of education in citizenship and industry.

The Mill Session was held Wednesday, the final day of the meeting. Reports of standing committees on Accident Prevention and Insurance, Conservation, and Technical Problems, and Papers for Mill Sessions were presented.

A meeting of the new board of directors was held on Tuesday afternoon, and an announcement followed this session that the spring meeting of the Association will be held at the Biltmore Hotel New York City, May 26-28, 1930.

J. L. Senior

The Value of Finely Pulverized Coal

Every cement mill engineer certainly knows that tremendous power is inherent in combustible dust. Many an industrial plant has been destroyed by dust explosions. Many a coal mine disaster has been caused by the explosion of coal dust. In fact, the Department of Agriculture of the United States has recently been exhibiting an internal combustion engine run entirely on dust, the force of the explosions being sufficient to cause the engine to deliver power.

In order to obtain quick or almost instantaneous combustion of any combustible material, it is necessary to increase the surface of the material being burned. Thus, if you take a piece of wood and cut it into shavings, you know from experience that the shavings will be consumed by fire much more quickly than the original piece of wood would be consumed. Make the shavings as fine as excelsior and complete combustion will occur in a surprisingly short time.

Let us, for example, take a lump of coal which is an exact one-inch cube. It has six faces and each face is one inch by one inch, giving us a total surface of six square inches.

Now let us cut up that inch cube into a great many tiny cubes so small that each cube will be only 1/200 of an inch on each edge. In other words, the coal will be fine enough to pass through a so-called "120-mesh sieve." It is easy to figure that there will be 8,000,000 tiny cubes, that each cube will have a surface area of 6/40,000 of a sq. in., and that the total area of the cubic inch block will be increased from 6 sq. in. to 1,200 sq. in. In other words, its surface will be 200 times as great.

But coal dust that is really fine is finer than 8,000,000 cubes per cu. in. The finest testing sieve in the world has 400 meshes per inch, or 160,000 square openings per sq. in. The wires are one-thousandth of an inch in diameter. To pass through this sieve the coal particles must be smaller than 1/666 in. on each edge, and there would be a total of 295,000,000 such cubes per cu. in. of coal. The surface would be increased to 3,996 sq. in. Coal of this extreme fineness burns so quickly that most people would call its combustion an "explosion," much like the burning of gas.

Even fuel oil must be pulverized or "atomized," as they call it, before it will burn properly under a boiler. That is why the combustion of pulverized coal and atomized oil are so much the same. It is an acknowledged fact that the more thorough the atomization of the oil the better the combustion, because the more finely divided the oil is the closer its approach to the ideal gaseous state. Similarly, the finer the pulverization of coal the closer is its approach to the ideal gaseous state.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

John G. Carpenter
President, Madison Sand and Gravel Corporation,
Susquehanna, Pa.

Concerning Screw Conveyor Accidents

FOLLOWING the reading of the paper, "Eliminating the Screw Conveyor Accident," by M. S. Humphreyes, before the Cement Section of the National Safety Congress, A. J. R. Curtis, assistant to the general manager of the Portland Cement Association, read several letters. The three letters presented here, recently released by the National Safety Council, should prove of considerable interest, especially to the cement industry. The interesting paper was published on page 65, October 23 issue of PIT AND QUARRY.

Dear Mr. Curtis:

I will endeavor to give you the story of our screw conveyor accident as I understand it.

On the morning of February 5, 1929, William Lanigan was ground to death in the screw conveyor under our packing floor. Lanigan's work consisted of drawing the cement from the various bins and seeing that it reached the elevator to be raised to the packing bins. On the morning that he was killed by some coincident, the inspector who was one of the working men of the plant went down into the basement of the packing house and talked to Lanigan for a few minutes. While he was there the packing house foreman went down to give Lanigan instructions as to which of the bins he was to draw from. While the three of these men were there the man in charge of our yard and locomotives went down to talk to the packing house foreman. All of these men say that the steel plate which was over the screw conveyor at this point was in place and that they had been standing and talking to Lanigan for two or three minutes and then left him to start the drawing from these bins. About ten minutes after these various employees had left the basement the motor driving the elevator and screw conveyor stopped and the repairman started to locate the trouble. The first thing that he did was to go into the basement and found that the screw conveyor was stopped. Incidentally he looked for the man drawing cement into the conveyor to see if he knew why the conveyor was choked. When he got back almost to the place where Lanigan was supposed to be working, he saw a hand sticking out from under the raised cover and, of course, immediately knew that some one was in the conveyor. On trying to find Lanigan, of course, he was not in his place and he immediately concluded that the old man had been pulled into the conveyor.

From all indications it seems that he had a slide of cement from the bins which ran out into the tunnel, and in his hurry to clean this up he loosened the steel cover over the conveyor and was pulled in and pushed up the next hangar, stopping the motor. The body was badly mangled and beyond recognition, the only way we knew that it was he was due to some papers that he had in his pockets.

About two feet from the place where he loosened this cover there was a grate made of angle iron and ½-in. round bars for the purpose of putting in any cement that needed to be cleaned up, but this point was not quite as handy to get at as the place where the conveyor cover was raised. In other words, it would have taken a little more effort to have shoveled the cement in through the grating than to push it in at the point where the cover had been loosened.

We had thought that by providing the above gratings at each alley-way to the various bins that we had made the necessary provision so that there would be no such accident as the one above described, but apparently our plans and orders were not adequate to prevent a man getting into the conveyor.

Immediately after this accident we had grates similar to the short ones above described made for all of our conveyors and had them bolted into place underneath the solid cover so that now in order for anyone to get into the conveyor they must remove the solid cover and then remove a section of the grating as well. We continue our inspections so that if any repairs are made on these conveyors that the repairmen do not leave the gratings lying on the floor when they have made their repairs and put on the solid cover only.

As you know, no matter how many rules you might make you must be continually following up the work of the various repairmen or you will find that they will leave your protection off as they think it is somebody else's duty to come along and see that the protection is in place.

Our rules with regard to the repair of mechanical devices include the locking of motor starters so that the man working on the equipment is the only one who can put the machinery into operation, the idea being to avoid someone thoughtlessly starting the motor in trying to accomplish some other result without looking to see if there is anyone at work on the piece of machinery that is down.

We have a safety committee which is to report any violations of the safety rules that we have and any unsafe practices which might come to their notice as well as an inspector who is one of the employees. He looks over all of our many departments with the idea of seeing if there are any unsafe practices or any guards left out of position. He is expected to make his rounds of all departments and report upon his findings weekly.

Yours very truly,

NORTH AMERICAN CEMENT CORP.
G. A. WITTE,
Asst. Gen'l Manager.

Dear Sir:

Complying with your request of September 7th with reference to a report of our screw conveyor accident in our warehouse on May 1st, 1929, such information to be used in connection with Mr. Humphrey's paper to be read at the National Safety Council in Chicago on October 1st, we are very glad to submit any information we have that will be a benefit to our member companies.

Our only screw conveyor accident happened on May 1st, this year, in our warehouse, to one of our cement pullers who had been doing this work for eight years. For 18 years the screw conveyors in our warehouse had been covered with No. 6 wire, 2-in. diamond mesh screens.

On May 1st our cement puller stepped through the wire guard, his foot was caught by the screw conveyor and his leg drawn in and severed at the thigh. It was only a few moments before the other cement pullers heard his cry and they immediately stopped the conveyor and offered first aid to the injured. One of the men who gave first aid had been trained in first aid work and held a card from the U. S. Bureau of Mines, for efficiency in this work, and it was this man who prolonged the life of the injured man by applying pressure at the nearest pressure point and thereby prevented the victim from bleeding to death.

From the results of this horrible accident we felt that we could take no more chances with the screen guards and hence we immediately re-

placed the No. 6 wire screens with three-fourths inch Trilok steel grating, which move we trust will prevent any repetition of like accidents.

If there is anybody in doubt about the horrors of a screw conveyor accident, let him compare the screw conveyor with an ordinary meat chopper and he can see how the two machines do their own work of grinding meat and bone or anything else that is put into them. By using the imagination one can readily see the terrible potentialities of the screw conveyor when fed with human flesh and bone.

We trust the above information will be of assistance to you, and you shall be able to incorporate this account in your report.

With kind personal regards, I am
Yours very truly,
LONE STAR CEMENT COMPANY,
NEW YORK, INC.,
C. S. ANDRES, Superintendent.

Dear Mr. Curtis:

Complying with your request to describe the screw conveyor accident that resulted in a fatality in June, I wish to advise as follows:

The deceased was employed in feeding cement from our stock bins into conveyors leading to the packing department. The operation consists of pulling the cement into conveyors by means of a light wide hoe having a long pipe handle. The bins are 34x36½x12½ ft. deep and contain from 3,500 to 3,900 barrels of cement. Each bin is supplied with four 9 in. screw conveyors having shafts extending through the rear walls where the power is applied. The conveyors are covered with a heavy screen having 1¼ in. openings and they rest in depressions 2 in. deep by 4 in. wide, running on either side of the troughs. The troughs are deep—the conveyor having about 4 in. clearance above it. Prior to filling the bins the conveyors are covered with heavy steel plates also resting as above described. These plates are 4 ft. long. When a bin is opened the cement is caused to fall into the conveyor by gradually removing the plates. As space is made they are set aside until the bins are to be filled again.

The operation is perfectly safe provided the screens are not removed. In this case, however, the operator violated the instructions that had been given through a period of about eighteen years, during which time millions of barrels of cement were handled without an accident. Removing one of the screens was the line of least resistance to make work easy and increase the pay. Pullers are paid by the hundred barrels handled. So the deceased pulled one of the screens back about 18 inches and forgot that the screen was uncovered, resulting in his foot being drawn into the conveyor. His injuries consisted of bruised toes and both bones of the left leg being broken above the ankle. The injuries were not considered at all serious. However, death resulted three days later from the effects of anesthetics. In the opinion of the attending surgeon and physician the anesthetic had the effect of forming certain gases in the stomach which could not be eliminated. The pressure of these gases against the heart weakened it to such an extent that death ensued.

In order to prevent repetition of similar accidents we have decided to place a clamp over the screens where the sections overlap, and bolt it firmly to the concrete trough.

We have no particular regulation regarding the operation of screw conveyors other than our regular educational method of instructing men against removing lids therefrom. All screw conveyors other than those in the floor of the stock house are provided with angle irons riveted to the bottom of the conveyor cover. These fit inside of the casing and the cover can not move if anyone should step on it. Of course, positive orders are given frequently that lids must not be removed. With covers so constructed we feel the conveyors are amply protected and have no mechanical protection for the benefit of those who might be working near them.

In the case of repairs—conveyors are always down during this operation, in any event. We make it a practice to have a man stand guard over the starter operating the motor drives until the conveyor is repaired.

Yours very truly,
PENNSYLVANIA-DIXIE
CEMENT CORPORATION,
F. GUENTHER, JR.,
General Superintendent.

Coming Events

Dec. 6, 1929. Indianapolis, Ind. Meeting, Indiana Sand and Gravel Association at Claypool Hotel. S. C. Hadden, executive-secretary, 603 Occidental Bldg., Indianapolis.

Dec. 10-31, 1929. Santiago, Chile. International Railroad and Road Exposition. Secretary, San Martin 352, Santiago, Chile.

Dec. 12, 1929. Pittsburgh, Pa. Meeting, Steel Founders' Society of America. G. P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

Dec. 12-13, 1929. Washington, D. C. Annual meeting, Highway Research Board, at the National Academy of Science and National Research Council.

Jan. 11-18, 1930. Atlantic City, N. J. Annual convention and show, American Road Builders' Association. Chas. M. Upham, secretary-director, 914 National Press Bldg., Washington, D. C.

Jan. 20-23, 1930. Cincinnati, O. Annual convention and Manufacturers' Division Exposition, National Crushed-Stone Association, at Hotel Gibson. J. R. Boyd, secretary, Merchandise Bldg., 14th and S Sts., N. W., Washington, D. C.

Jan. 28-30, 1930. Memphis, Tenn. Annual convention and Manufacturers' Division Exposition, National Sand & Gravel Association, at the Peabody Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Jan. 29-30, 1930. Milwaukee, Wis. Annual convention, Wisconsin Concrete Products Association, at Hotel Plankinton.

Feb. 11-13, 1930. New Orleans, La. Annual meeting, American Concrete Institute, at the Roosevelt Hotel.

Feb. 16-20, 1930. Toronto, Can. Thirty-second annual meeting, American Ceramic Society at Hotel Royal York. Gordon C. Keith, secretary-treasurer, 49 Turner Road, Toronto 10, Canada.

Feb. 25-28, 1930. Wichita, Kan. Fifth annual Southwest Road Show and School at the Coliseum. Secretary, P. O. Box 1043, Wichita, Kan.

Mar. 3-7, 1930. Chicago. National Industrial Exposition at the Stevens Hotel. George Pfisterer, secretary, 308 W. Randolph St., Chicago.

Apr. 5-9, 1930. New York, N. Y.; Hoboken, N. J.; Washington, D. C. Fiftieth anniversary meeting, American Society of Mechanical Engineers, at American Machinist offices in New York; Stevens Institute, Hoboken; U. S. Chamber of Commerce Bldg., Washington.

April 7-11, 1930. Atlanta, Ga. Annual meeting, American Chemical Society.

May 12, 1930. Cleveland, O. Meeting, Steel Founders' Society of America. G. P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

June 16-25, 1930. Berlin, Germany. World Power Conference. World Power Conference Program Committee, Room 818, 29 W. 39th St., New York, N. Y.

PERSONAL MENTION

R. B. McKinney has been appointed assistant to the general manager of the Explosives Department of the Hercules Powder Company. Mr. McKinney was formerly director of purchases. His successor in that position is **F. P. H. Sholly.**

Charles P. Clampitt has taken charge of the Chicago office of the Alexander Milburn Company, Baltimore, Md. The Chicago office is located at 220 South State street.

Harold K. Ferguson, president of the H. K. Ferguson Company, Cleveland, O., addressed the convention of the National Association of Real Estate Boards on November 20 at St. Louis.

Howard G. Wright, formerly chief engineer of the North American Cement Company, Catskill, N. Y., has joined the staff of the Hardinge Company as research engineer in the cement machinery department. Mr. Wright will devote a large part of his time to working up engineering data for the various classes of Hardinge equipment used in cement plants.

Walter Young, general traffic manager of the Atlas Portland Cement Company, 25 Broadway, New York, has resigned his position. His successor has not been announced.

J. B. Alexander has succeeded W. F. Mackenzie as chief chemist of the Osborn, Ohio, mill of the Southwestern Portland Cement Co.

John L. Mason, formerly sanitary engineer for the Water Works Supply Company, San Francisco, Cal., has become sewage research engineer for the Hardinge Company. Mr. Mason has had extensive experience in the sanitary field, having worked on the design or manufacture of a large part of the mechanical equipment installed in recent sanitation plants in the far west.

Thomas W. Pangborn, president and general manager of Pangborn Corporation, Hagerstown, Md., is being congratulated by his many personal and business friends on the observance of the corporation's twenty-fifth anniversary. The Pangborn corporation, manufacturers of sand-blast and dust-collecting equipment, started business in 1904.

H. J. Hassler, assistant chief engineer of The H. K. Ferguson Company, Cleveland, O., has been placed in charge of the planning, coordination and management of all Ferguson layout and engineering work, both in Cleveland and elsewhere throughout the United States. **James A. Meacham,** specification engineer, has been appointed engineer in charge of research and inspection.

Dr. K. F. Vaughn, research engineer for the Tricosol Corporation of America, addressed the Seattle Chamber of Commerce at its noon luncheon November 6. Dr. Vaughn spoke on the effectiveness of tricosol as a waterproofing agent in cement in its relation to the mining industry.

Earle S. Philips, vice-president of the Good Roads Machinery Company, visited Chicago recently to complete arrangements for the transfer of the company's Chicago headquarters to the Builders' Building. For several years past the company had maintained branch headquarters at 49th and Halsted streets. The new location, to be occupied after January 1, will be closer and more convenient to the Loop district.

R. W. Baird of the Oceanside Rock and Sand Company of Carlsbad, Calif., has taken over another sand plant for his company. The new plant is located just north of Oceanside. The company now has three thriving plants in that vicinity.

C. D. Smith has moved to Knights Ferry, Calif., from Los Angeles, where he has acquired some extensive gravel beds on the Stanislaus River. He plans to begin production at an early date.

J. W. McKinley and **F. W. Goodes** have joined the field staff of the La-France Republic Sales Corporation, according to an announcement by Vice-President F. D. Soper. Mr. McKinley has been assigned to the following territory: Indiana, Illinois, and part of Iowa, Missouri, and Wisconsin. He succeeds **John W. Hansen,** who has been forced to resign because of ill health. Mr. Goodes will have charge of sales work in Kansas, Nebraska, Colorado, Texas, Arkansas and part of Iowa. Several years ago he was branch manager for the Republic Truck organization at Baltimore.

Dr. W. H. Collins, director of the Geological Survey, Department of Mines, Canada, has returned to Ottawa after having attended the International Geological Congress in South Africa, where he represented the Dominion government and the Royal Society of Canada.

Bertrand Denis has been appointed staff geologist of the Provincial Mines Bureau of Quebec.

A. K. Lobeck, formerly of the geology department of the University of Wisconsin, has been appointed a professor of geology at Columbia University.

William G. Morgan, general manager of the Whiteurth Products Corporation, was a recent visitor in Chicago. This company owns a large deposit of high-grade diatomaceous earth in the desert region near Harper, Ore., and prepares products used commercially in insulation, filtration, and cement mixtures.

Walter C. Hecker was recently appointed president of the Curtis Manufacturing Company and its subsidiaries, the Curtis Pneumatic Machinery Company, Curtis Saw Company, and the Curtis Clutch Disc Company. He became associated with the Curtis organization in 1905 as sales manager and subsequently became secretary and senior vice-president. E. H. Steedman, retiring president, remains on the board of directors.

Otis Mouser, president of the Whitehall Cement Manufacturing Company of Philadelphia, Pa., died recently.

Claire R. Deneau, 32, employed at the Oxford, Mich., gravel pit of the American Aggregates Company, was fatally injured November 10. Deneau met his death under a slide of gravel, which started when he attempted to loosen the mass with a shovel after it had jammed in a chute. Fellow workmen recovered the body 15 minutes after the accident. The deceased was a native of Ionia, Ontario, where the body was sent for burial. He is survived by a widow and one son.

Dr. Edward Philbrick, 72, said to have made the first discovery of phosphate deposits in Florida, died recently at Miami. Dr. Philbrick was a native of France.

INSURANCE PROBLEMS DISCUSSED

Power Equipment

The only form of insurance, it is claimed, which shows a direct profit to every purchaser, is machinery insurance. This field of indemnity, covering accidents to steam boilers, engines and electrical equipment, is among the most advanced technically, and is especially important to producers in our industries. It pays its own way because the auxiliary service furnished by the insurance companies is possibly greater than the payment of losses.

Power equipment is the heart of your production, whether you have a complete plant or merely electric motors supplied by a central station. When the power stops, your whole organization is idle. Yet in face of the skilled mechanics and other safeguards we adopt to protect ourselves from interruption of the power supply, just consider the actual conditions in the case of such universal equipment as steam boilers. Of all boilers inspected by a certain insurance company one in seventy has scale to a dangerous degree, one in sixty has an insecure stay bolt, and one in seven has a serious defect of some sort. The energy chained up inside a boiler is like dynamite or gunpowder. Boiler explosions are the most severe industrial catastrophes, and all boilers are potentially explosive since they are constructed of materials which may be defective and manned by engineers who sometimes make mistakes.

Steam Boilers

Boiler insurance follows somewhat different principles from either fire or workmen's compensation, the forms of coverage with which producers are most familiar. It is a two-way proposition. The policy covers damage to the insured's own property caused by explosion, and at the same time it covers the liability for injuries suffered by other persons. In buying a boiler policy, therefore, you choose an amount big enough to include the estimated maximum of damage to your plant plus an allowance for indemnity in personal injuries damage suits.

While defective boilers are common and explosions frequent in general, an insured boiler seldom explodes. For every insured boiler is subject to constant inspections. During the dull season a specialist climbs inside the boiler with a chisel and hammer to look for tiny cracks and traces of scale. During the producing season the insurance inspectors test every boiler one or more times while it is in operation. These tests accomplish three purposes. They prevent explosions, they discover leaks and other defects while small enough so that repairs are easy and cheap, and they keep the plant engineers "on their toes" because the inspector will report any serious condition to the management directly. This inspection work costs more money than the payment of losses, and it is one of the greatest public services rendered by insurance companies.

Boiler policy holders may also get other direct help from the insurance engineers. For no extra cost over the regular premium, a plant owner may periodically submit samples of the feed water for laboratory analysis to see if it contains any chemical elements which either harm the boiler or reduce its efficiency. Insureds often get constructive advice from the inspectors on fuel conservation, firing methods and the selection of fuel from the standpoint of economy and correct combustion. These insurance engineers will even give help without charge in drawing up plans for new boiler installations.

Gas Explosions

The large scale introduction of oil and gas as fuel for industrial furnaces have very recently led to an extensive revision of the insurance form. The basic policy covers only damage done by explosions of steam inside the boiler. But lately we have witnessed many terrific explosions of gas either in the firebox or in the flue. Many plant owners underestimate the likelihood and extent of damage caused by these gas explosions, and we call this especially to the attention of those who are now carrying the old type of coverage and who might profitably have their policies endorsed to include the gas feature.

There is a trade peculiarity in our industries which makes our insurance needs somewhat different from those of the store and factory. In many cases the direct loss due to destruction of the plant is less than the loss of income during the months necessary to rebuild after loss. Suppose your boiler should explode just at the beginning of your busy season. The physical loss might be only a few thousand dollars. But before you could resume operation your profit for a whole year might be gone. Protection against loss of income, called "business interruption" or "use and occupancy" insurance, is obtainable in boiler, engine and electrical equipment policies. If you ask your insurance agent for information on any of these, you should also get figures on the income protection.

Engine Breakage

Engine breakage insurance, while important to industry as a whole, concerns only those producers who have their own complete power plants. Originally this was known as flywheel insurance. Everyone recognized that the mechanisms holding flywheels in check are very delicate and when a big wheel gets out of control the resulting damage is terrific. The old policy, therefore, covered only the sudden rupture or explosion of the fly-wheel. This form of policy is still used somewhat, but it has been largely superseded by a broader policy covering accidental breakage in any part of the engine.

Electrical Equipment

The electrical equipment of today is well constructed and will stand a lot of ordinary wear and tear. But most of our electrical devices, especially motors, are operated in connection with other machinery. They are handled by workmen who have no special knowledge of electricity and are consequently subject to abuse or lack of care. Burnouts and grounds are common, to say nothing of such external causes as line surges and lightning. The electrical machinery policy agrees to pay for all damage to the device itself and other property from any cause except ordinary wear and tear. The main value of the coverage lies in the fact that an insurance company makes frequent expert examinations of the equipment. The inspectors detect small grounds, short circuits and worn insulations. Their principle is to catch defects in the early stage and correct them before any serious breakdown occurs. Through this policy of watching the details alertly the surprising truth develops that most firms can cover their electrical maintenance by insurance cheaper than they can make repairs themselves. At the same time correcting the little defects reduces the rate of physical depreciation and adds one or two years to the average life of electrical equipment.

The above forms—boiler explosion, engine breakage and electrical machines—can be obtained from almost any of the large casualty companies, and your regular insurance broker can secure rates and sample policies for you.

RECENT PATENTS

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited below. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

American

Revolving scraper. Bruce E. Rose, Stockton, Cal. 1,734,347.

Impact pulverizer. Wilfred R. Wood, London, England, assignor to International Combustion Engineering Corporation, New York, N. Y. 1,734,661.

Means for transporting concrete. Earle S. Phillips, Kenneth Square, Pa., assignor to American Road Machinery Co., same place. 1,734,980.

Means for transporting concrete. Earl S. Phillips, Kenneth Square, Pa., assignor to American Road Machinery Co., same place. 1,734,981.

Process and apparatus for drying and pulverizing coal. Frederic I. Barrows, Indianapolis, Ind. 1,734,992.

Car-dumping device. Joseph B. Strauss, Chicago, Ill. 1,735,022.

Screen. William S. Weston, Columbia, S. C. 1,735,067.

Excavator. Jesse E. Mattinson and Ernest J. Moody, San Francisco, Cal. 1,735,122.

Feed-wheel for pneumatic concrete-machines. Alphonse T. Cassiere, Long Beach, Cal. 1,735,233.

Gravel-spreader. Elbert L. Pardue, Huttington, Tenn. 1,735,297.

Track-laying attachment (for power shovels). Grover C. Voit, Hopedale, Ohio. 1,735,306.

Air-separator (for grading materials). Thomas J. Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co., Boston, Mass. 1,735,479.

Means for tempering water for concrete-mixers and for cooling the motor therefor. John C. Merwin, Milwaukee, Wis., assignor to Chain Belt Co., same place. 1,735,615.

Pitch-shackle (for power shovels). Roy H. Anderson, Long Beach, Cal. 1,735,716.

Gravel-washer. Francis R. Dravo, Edgeworth, Pa., assignor to Dravo Contracting Co., Pittsburgh, Pa. 1,735,738.

Pulverizer. Horace Waring, Liverpool, England, assignor to Associated Lead Manufacturers, Limited, London, England. 1,735,985.

Jigging mechanism. Martin J. Lide, Birmingham, Ala. 1,736,008.

Teeth for excavating-dippers and the like. Walter E. Miley, Marion, Ohio, assignor to Marion Steam Shovel Co., same place. 1,736,045.

Separator for granular material. George F. Royer, Wilkes-Barre, Pa., assignor to Royer Foundry & Machine Co., same place. 1,736,054.

Apparatus for treating and blending molders' sand. George F. Royer, Wilkes-Barre, Pa., assignor to Royer Foundry & Machine Co., same place. 1,736,055.

Appratus for feeding and metering pulverent material. Ervin G. Bailey, Cleveland Heights, Ohio, assignor to Fuller Lehigh Co. 1,736,243.

Concrete-road-finishing machine. Erich H. Lichtenberg, Milwaukee, Wis., assignor to Koehring Co., same place. 1,736,412.

Concrete-road-finishing machine. Erich H. Lichtenberg, Milwaukee, Wis., assignor to Koehring Co., same place. 1,736,413.

Derrick. Arvey Smith, Winchester, Ill., assignor to Koehring Co., Milwaukee, Wis. 1,736,419.

Tooth for crushing-rolls. George W. Wilmot, Hazleton, Pa., assignor to Wilmot Engineering Co., same place. 1,736,563.

Excavating-machine. Robert B. Muffett, Ridgefield, Wash. 1,736,661.

Concrete-mixer water-supply means. Ferdinand H. Heine, Milwaukee, Wis., assignor to Koehring Co., same place. 1,736,744.

Mixing-machine-control signaling-indicator. John F. Robb, Cleveland, Ohio, assignor to Koehring Co., Milwaukee, Wis. 1,736,751.

Foreign

Crushing mills. E. C. Loesche. British 313,690; 313,844.

Crushing, grinding or milling apparatus. R. E. Trottier. British, 296,723.

Grinding, crushing, pulverizing or disintegrating mills. W. A. Cloud. British 313,656.

Manufacture of absorbent silica. E. B. Miller and G. C. Connolly. British 287,066.

Avoiding dust in hydration of lime and like processes. S. Travis and Callow Rock Lime Co. British 314,561.

Electric kiln for manufacture of cement and lime. H. J. Benham. British 316,715.

Purifying fused cements. Soc. d'Etudes Chim. pour Ind. British 298,637.

Manufacture of plasters from anhydrite. V. Lefebure. British 317,672.

Calcining limestone and cement. Louisville Cement Co. British 306,856.

Rotary kiln for burning cement by the wet method. A. V. Jensen. British 306,613.

Colored Sand. G. H. Hadfield and Sand and Shingle, Ltd. British 307,448.

Cooling shaft for burning cement. Klockner Werke, A. G. German 480,525.

Process for the production of fused portland cement from blast furnace slag and limestone. O. Keune. German 482,327.

Conveyor for stone and other material for shaft kilns. W. L. Meyer. GM. German 1,091,184.

Coloring cement. A. N. P. Jacob. French 658,841.

Rotary cement kiln. G. Polysius. French 658,843.

Rotary kiln for cement, lime, etc. A. Anker French 658,206.

Procedure for the purification of fused cements. Societe d'Etudes Chimiques pour Industrie & F. Düring. German 87,652.

Process for the simultaneous transportation and cooling of cement clinker. A. Andreas. German 56,382.

Process for burning cement by the wet method with partial removal of water before burning. G. Polysius A. G., O. Lellep & G. Roock. German 58,466.

Process for waterproofing building materials, walls, cellars, etc. A. J. Buitenhuis. German 127,074.

Production of extremely porous artificial stone. K. Gebhard. German 72,353.

Drying apparatus for clay, sand, etc. R. de Reyterre. German 73,563.

Hammer mill in closed housing. Hartsoff Metall A. G. German 115,257.

Conical concrete mixer for continuous or intermittent discharge. Gauhe, Gockel & Cie. German DRGM 1,087,345.

Directly driven electrical mortar mixers. G. Berger. German DRGM 1,087,986.

Concrete mixer, mixing and emptying on a horizontal axis. K. Piehler. German 54,288.

Rotary kiln for burning cement. A. W. Jensen. German J. 36,228.

FINANCIAL NEWS
CORPORATE & BUSINESS

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

General Asphalt Co. Position Improved

There are now approximately 308,000 no-par shares of General Asphalt Co. common stock outstanding on which the initial quarterly dividend of $1 has been declared. Under the recent recapitalization plan, the old $100 par common was exchanged for the present no-par stock on a share for share basis.

The bonds and preferred stock have been converted and retired, which paved the way for dividends on the common stock which now have been started.

Following the retirement of the preferred stock next month, the common stock will constitute the sole capital obligation of the company. Upon completion of the stock allotment outstanding common stock will total 413,333 no-par shares. Allotment was made at $50 on the basis of one new common share for each three shares held to stockholders of record October 23 and was to provide funds for the redemption of such bonds as were not converted into common stock. The offering was underwritten by Drexel & Co.

Indications are that the company will make a much better report for 1929 than it did for 1928. For the first half of this year General Asphalt reported net profit of $461,760, equal to $1.41 a share on the common stock then outstanding, compared with a net loss of $339,241 for the first half of 1928. The second half of the year is usually the best from an earnings standpoint and a substantial improvement in net profit for the six months ending December 31 is expected. Although the company has made no report for the third quarter, unofficial estimates have placed it at approximately $800,000.

The directors have just declared an initial quarterly dividend of $1.00 a share on the new common stock, payable December 16 to holders of record November 26. This action substantiates the above estimate that the third quarter will net $800,000. This compares with $461,760 earned in the first six months of this year and $920,506 for the entire year 1928.

The Stock Market Break As Seen By Several Leaders

Portland Cement Association Head Not Alarmed

"The construction industry finds no cause for alarm in the recent market crisis because of the ample stocks of high-grade materials available at fair prices and with money both plentiful and cheap," states Wm. M. Kinney, general manager of the Portland Cement Association.

"Contractors are in excellent position to capitalize their skill and to profit from well planned merchandising. The opportunities inherent in winter construction should be recognized with results certain to be beneficial to every phase of building industry from architecture to labor."

Confidence of Atlas Portland Cements' President Unshaken

"The liquidation in stocks has in no way affected our confidence either in our own industry or in other sound enterprises. On the contrary, we believe that buildings and mortgages which at one time seemed unattractive will again come into their own. The fact that foreign cement is allowed to come into this country duty free, to compete with our higher costs, owing to high labor, prevents my looking for a successful period in that particular line until the tariff question is settled as we hope it will be." This was the statement of John R. Morron, president of Atlas Portland Cement Co.

Indiana Limestone President Sees Big Year

The building industry faces splendid prospects for the coming year, according to A. E. Dickinson, president of Indiana Limestone Co.

"There is a large government program. Corporations have building programs that may make total figures the largest in history. Liquidation in the stock market has taken place and large sums of money will be available for mortgage bonds. Indiana Limestone Co. has a larger amount of orders than ever before in the company's history, and we are optimistic over the future," Mr. Dickinson said.

Structural Gypsum Head Still Optimistic

In reviewing the market crash, G. Lester Williams, president of Structural Gypsum Corporation, stated, "If we keep in mind that the recent stock market hysteria has produced a collapse of prices but not of sound

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Preferred	1¾% qr.	Dec. 1	Dec. 15
Atlas Portland Cement	Common	$.50 qr.	Nov. 16	Dec. 3
Canada Cement	Preferred	1⅜% qr.	Nov. 30	Dec. 31
Canada Paving and Supply	1st Pfd.	1¾% qr.	Nov. 15	Dec. 1
Cleveland Stone Quarries	Common	$.75 qr.	Nov. 15	Dec. 1
Cleveland Stone Quarries	Common	$.25 extra	Nov. 15	Dec. 1
General Asphalt	Common	$1.00 qr.	Nov. 26	Dec. 16
General Asphalt	Preferred	1¼% qr.	Nov. 15	Dec. 1
General Refractories Co	Common	$.75 qr.	Nov. 12	Nov. 26
Grant Portland Cement	Preferred	$1.75 S A.	Dec. 2	Dec. 16
Indiana Limestone	Preferred	1¾% qr.	Nov. 20	Dec. 1
Kentucky Rock Asphalt	Preferred	1¾% qr.	Nov. 15	Dec. 3
Lawrence Portland Cement	.....	1% qr.	Dec. 14	Dec. 30
Material Service Corp	.....	$.50 qr.	Nov. 15	Dec. 1
Metropolitan Paving Brick	Common	$.50 qr.	Nov. 15	Dec. 1
National Brick of Laprarie	Preferred	$.75	Nov. 31	Dec. 16
Pacific Portland Cement	Common	$2. spcl.	Dec. 14	Dec. 18
Peerless Cement	Preferred	$1.75	Dec. 20	Dec. 31
Raybestos Manhattan	Common	$.65 qr.	Dec. 2	Dec. 16
Standard Paving Materials, Ltd	7% Pfd.	1¾% qr.	Nov. 2	Nov. 15
Standard Paving Materials, Ltd	Common	$.50 qr.	Nov. 2	Nov. 15
Superior Portland Cement	Class A	$ 27½ M	Nov. 23	Dec. 1
Texas Gulf Sulphur	.....	$1.00 qr.	Dec. 2	Dec. 16
Virginia Carolina Chemical	Pr'r Pfd.	1¾% qr.	Nov. 17	Dec. 1
Worcester Salt Co	Preferred	1½% qr.	Nov. 10	Nov. 15
Wolverine Portland Cement	.....	$.15 qr.	Nov. 5	Nov. 15

values, there is no basis for a lack of confidence in the continued prosperity of the country's basic industries. On the contrary, money heretofore diverted into speculation should now begin to find its way back into and stimulate legitimate business. I feel that this will be especially reflected in the building industry, releasing many projects which for the past year have been held up through inability to finance except on an unsound basis."

Two Billion Dollar Building Program Expected

A building program closely approximating $2,000,000,000 may be counted on during the ensuing six months, as the building industry's contribution to continued prosperity, President Roberts of S. W. Straus, investment bankers specializing in mortgage securities, states.

"This program is exclusive of major engineering projects," he explained. "It does not include street and highway construction, bridges, highways and similar projects. It pertains only to private and public buildings for which building permits must be secured.

"Official reports to S. W. Straus and Co. of building permits issued from 600 principal cities and towns where the bulk of building exists, show building operations for six months, from December 1 to May 31, have not greatly varied during the past four years. From December 1, 1925, to May 1, 1926, the total was $2,176,082,750. During the same period the following year it was $2,004,012,088. For the winter and spring season of 1927 and 1928, permits were $1,994,359,908, and for the half year beginning December 1, 1928, and ending May 31, 1929, the total was $1,996,161,317.

"During the latter months of this year there has been a rather pronounced slowing down in building activities and it is possible that for a few months more this downward movement will continue. However, three major factors before a great while should materially change conditions for the better. These are:

"(1) The period of easy money into which we have now definitely entered.

"(2) The vigorous efforts undertaken by President Hoover and the united business interests of the country to stimulate activities along every possible line.

"(3) The increased demand created in most types of buildings through slackened activities in recent months.

"We believe, therefore, the ensuing six months' period beginning December 1 should, on a conservative estimate, offer nearly as much potential public and private building as during the similar period of the year just ending, when the volume was but slightly less than $2,000,000,000."

New Contracts for Warren Brothers

Warren Brothers Co. is making satisfactory progress on its contract for construction of more than six miles of road in or near Guatemala City, Guatemala. Work will be of the same quality as that on the Central Highway of Cuba and is expected to be completed within nine months.

This contract itself is less significant than the possibilities inherent in it, constituting as it does, the first contract of the Boston road building organization in Guatemala. Possibilities of additional work in the republic are promising.

Another contract for construction of three kilometers (1.86 miles) of road leading from Valencia, Spain, to Madrid has been awarded the local licensee of Warren Brothers. Full length of the highway is 350 kilometers (217 miles) and the award is important because competition for it was very keen. Prospects for constructing the entire road are good.

The award is also significant in that it is the first contract of Warren Brothers covering work just outside Valencia. Since the first of the year some 100,000 square meters of road have been constructed by the company within the city limits.

Current operations of Warren Brothers are looking up and indications are that earnings for the closing four months of the year will maintain the rate established earlier. For the eight months ended August 31, net income of $2,167,774 was equivalent to $13.17 a share on 156,724 common shares, after preferred dividends and compared with $1,126,521 in the corresponding 1928 period.

The company has in prospect several other projects in foreign fields.

Warren Brothers owns thirty-nine acres located in Multnomah County, Oregon, near the city of Portland where it operates a quarry and manufactures most of its bituminous paving material.

Duval Texas Sulphur Splits Stock

Stockholders of Duval Texas Sulphur Co. have authorized a change in the present capitalization of 100,000 shares of $10 par value to 550,000 shares of no-par value. Five new shares will be issued for each share now held. The additional 50,000 shares not required for the splitup will be held in the company's treasury for expansion purposes.

Production of the company has just been reported to the Texas State Department and has been as follows since the company started operations: fourth quarter 1928, 4,872 tons; first quarter 1929, 7,230 tons; second quarter 1929, 9,573 tons; third quarter 1929, 11,601 tons.

Current production is running about 125 tons daily and in the first half of November production was 1,800 tons. The deposit is stated to contain in the neighborhood of 500,000 tons.

Canadian Asbestos Output Shows Big Gain

The province of Quebec, the largest asbestos producing territory in the world, valued its 1928 output at $11,238,361, according to figures just issued by the Mines Department of the Provincial government. This output represents an increase of a little over $750,000 over 1927.

During 1928 asbestos sold and shipped from Quebec mines amounted to 273,033 short tons, valued at $11,238,361. During the preceding year the figures were respectively 274,778 tons and $10,621,013, showing a decrease of 0.6% in tonnage but an increase of 5.8% in value. The average price a ton for all asbestos shipped during 1928 was $41.16 as against $38.65 in 1927.

Crude No. 1, the highest grade of asbestos mined in Quebec, brought an average value of $534.87 a ton. There were 893 tons produced during the year with a total value of $477,640 against a total value of $468,980 in 1927, when the output was 1,107 tons but the average price a ton, $423.65.

Crude No. 2 brought an average of $295.65 a ton in 1928, against $249.59 during the previous year. Crude run of mine came third, with an average value of $127.65 a ton in 1928 against $226.73 in 1927. Spinning fibre value was higher in 1928 than in 1927, averaging $148.71 against $129.32.

At the end of 1928 stocks of asbestos, all kinds, totaled 50,006 tons, valued at $1,879,257, against 56,812 tons, valued at $1,804,718, on December 31, 1927.

Pacific Portland Cement Declares Special Dividend

Pacific Portland Cement Co. declared a special dividend of $2.00 a share on the common stock, payable December 18 to holders of record De-

cember 14. This is the first dividend this company has declared since its consolidation with the Mission Cement Co.

Those two companies consolidated in 1927 and their initial financial statement and earnings record as reported for 1928 showed net income of $836,534, equivalent to $11.95 per share on the $6.50 preferred stock and $4.63 per share on the common stock. Gross income came to $1,500,000.

The brief report prevents any detailed analysis, but the company apparently began operations reasonably well, and at the close of the year reported current assets of $2,659,000 against current liabilities of $487,000, stating that it paid off $700,000 of notes payable in 1928 and retired $100,000 of its funded debt. Surplus at the close of last year was $1,101,000.

Apparently the company's earnings are running at a favorable rate this year in order to justify the declaration of this special dividend on the common stock.

Penn-Dixie Cement Defers Preferred Dividend

Directors of Pennsylvania-Dixie Cement Corporation have just voted to omit the quarterly dividend due at this time on the 7% cumulative preferred stock. It was stated that this action was deemed advisable by reason of the falling off in earnings resulting from the competition of duty-free cement, reduced domestic demands and drastic reductions in selling prices by competing companies. It was further stated that the cash position of the company is excellent, the balance sheet as of October 31, 1929, showing a ratio of current assets to current liabilities of nearly ten to one.

It will be recalled that in a recent number of PIT AND QUARRY per share earnings on the preferred stock were shown to be $5.05 for the year ended September 30, 1929. This compares with per share earnings of $7.20 for the year ended June 30, 1929, and per share results of $9.50 for the calendar year ended December 31, 1928.

Production of cement in September was 17,423,000 barrels against 18,595,000 in August, 17,884,000 in September, 1928, decreases of 7.4% and 3.7% respectively, these statistics covering the production for the country as a whole. At the same time, shipments totaled 19,950,000 barrels against 23,052,000 barrels in August and 16,799,000 in September 1928. However, building activity which is presently at a low ebb, may experience a revival later on so that demand from this source may become a more important factor in the cement sales in a few months. Another possible source of encouragement is that the present legislature may see fit to place a tariff on foreign cement.

Consolidated Rock Products

Consolidated Rock Products Co. will soon mail notices to holders of both preferred and common stocks of the company that certificates of the stock in permanent form will be ready for issue and delivery in exchange for the present temporary certificates on and after December 1, 1929.

Raybestos Placed on $2.60 Basis

Raybestos Manhattan, Inc., has declared an initial quarterly dividend of 65 cents, payable December 16 to stockholders of record December 2. This places the common stock on an annual dividend basis of $2.60.

The balance sheet as of September 30, 1929, shows current assets of $11,363,520 and current liabilities of $1,183,345, a ratio of better than 9.6 to 1. Cash funds including investments in municipal bonds amounted to $3,769,029. There are no bank loans, bonds, or preferred stock outstanding.

International Cement Earnings May Be Lower

The common stock of International Cement Company is currently selling at 55, representing an advance of 7 points from the low struck in the recent market break and contrasting with a high of 103 early this year. According to the latest advices this company is expected to earn in the neighborhood of $7 a share this year as against $7.90 in 1928. The third quarter earnings amounted to $2.20 a share, bringing the nine months' figure to $5.70, while the corresponding 1928 figures are $2.29 and $5.57, respectively.

International Cement is in a somewhat different position from other cement manufacturing companies in that nearly 50 per cent of its output comes from the company's mills in Cuba, Uruguay and Argentina, and consequently it has not felt the depression in the cement industry as badly as some of the other large companies that have no foreign production.

Portland Cement Prices Advanced

Following as it does on the heels of the great activity which is getting under way in the building program of this country, the raise in the prices of cement by several leading manufacturers should prove a wonderful factor in enabling these concerns to show increases in their earnings in the near future.

Pennsylvania-Dixie Cement Co. has advanced the price of Portland cement 20 cents a barrel in New York City; 30 cents around New England and New York State around the Hudson River Mills, and 30 cents a barrel in the Lehigh valley territory. This follows advance by other companies and it is probable that the industry generally will increase prices.

International Cement Co. states: "Our field men report that competitors have advanced prices 20 to 30 cents a barrel in the Lehigh valley and Hudson River districts and 10 to 50 cents in the southeastern district. If these reports are confirmed we will probably follow suit."

The Lehigh Portland Cement Co. has advanced its prices 30 cents a barrel in the Lehigh Valley and Hudson River districts, 20 cents in New York City and 10 to 50 cents in the southeastern district.

The advance in the southeast follows a long period of extremely low prices at which few companies could make profit on their production. The new level, while still leaving much to be desired, will likely allow for a nominal profit.

Marbelite Shows Gain

In a letter to stockholders, H. C. Stuart, secretary-treasurer of Marbelite Corp. of America stated that net profits for the nine months ended September 30 exceed those of a like period last year by $35,242.

Omission of regular dividends this year was occasioned by expenses accompanying the expansion program followed this year, Mr. Stuart said. He pointed out that expenses incurred by expansion were met without additional financing and that a surplus of $76,776 remains. Current operations give promise of another favorable report for the last quarter of this year, according to Mr. Stuart.

Balance sheet as of September 30, 1929, follows:

Assets

Cash	$ 36,612
Accounts and notes receivable	119,523
Inventories	113,156
Investments	205,670
Fixed assets	266,896
Patents, good-will, etc.	49,848
Total assets	$791,705

Liabilities

Accounts payable	$ 30,672
Accruals	43,972
Capital stock	640,285
Surplus	76,776
Total liabilities	$791,705

LEGAL INFORMATION FOR OPERATORS

County Officials Liable to Gravel Company

It is well established that public officials are personally liable for losses to others resulting from failure of the former to abide by the laws. This point was discussed in Bogue-Chitto Gravel Co. v. Parish of Lafourche, 122 So. 505.

The facts are that a Louisiana State Law provides that any party furnishing material for the repair or construction of any building or road may file with the recorder of mortgages, in the county where the work is done, a sworn statement of the amount due him "and any payments made thereafter by said authority (official) without deducting the amount of the claims so served on it, shall be *at his own risk.*"

A sand and gravel company furnished gravel to a contractor for the construction of a county highway. The gravel company filed a sworn statement with the county recorder of the amount due from the contractor for gravel. Subsequently the county authorities paid out all moneys due the contractor, and the gravel company sued the public officials personally to recover the amount due for the gravel.

The lower Court held the officials not personally liable, but the higher Court reversed this verdict, saying:

"We think that the word 'risk' used in the act was sufficient to fix the responsibility of the authority making the payments in disobedience to the requirements of that statute . . . it is further ordered and decreed that said Bogue-Chitto Gravel Company have judgment against defendant in the sum of $304.12, with 5 per cent. per annum interest."

Tax Assessment Notice Must Be Non-Ambiguous

In American Portland Cement Co. v. Certain Lands, 17 S. W. (2d) 281, an assessment book contained a description of land, as follows:

"Pt. west half of the northeast quarter of section 28, township 12 south, range 32 west, containing 11.48 acres."

The Court held this assessment notice void, because it does not clearly describe the property, and said:

"The object of the description of land on the assessment books, and in the subsequent proceedings leading up to and including the sale, is not only to inform the taxpayer what property is taxed as his, but also to inform the public, if the land is sold for the non-payment of the taxes, just what land is sold. The description is void, where it is so vague and indefinite that it in no way identifies the land."

Carrier Held Liable for Overcharge

In Gulf, C. & S. F. Ry. Co v. Minton, 14 S. W. (2d) 888, a shipper of gravel filed suit against a railway company to recover an overcharge of freight, resulting from incorrectness of the carrier's scales. The Court held the gravel company entitled to recover the overcharge, and stated the following important law:

"Appellant (carrier) was required by law to keep its scales in a correct condition and it held them out to the public as being in that condition . . . Public policy requires that freight charges be based upon correct weights."

Legal Interpretation of "All the Oil, Gas and Mineral Rights"

Since almost all of the oil and gas leases contain the clause "all the oil, gas and mineral rights," it is important to observe that recently in Praeletorian Diamond Oil Association v. Garvey, 15 S. W. (2d) 698, the higher Court held this phrase *not* to include clay and gravel rights. This Court said:

"We do not think that the abstract question of whether or not gravel is a mineral is necessary to be determined. . . . The intention of the parties as to what was being conveyed in the lease must be gathered from the four corners of the instrument. . . . We think it evident, when the instrument as a whole is considered, that it was not the intention to convey gravel. While it is true that the lease recites that 'all the oil, gas and other minerals' are conveyed, still it is manifest from the other provisions that gravel was not included. . . . The lease has no provisions for the mining of gravel, nor the caring for or disposing of gravel. . . . We think it is perfectly clear from the face of the lease that only such minerals—oil and gas—as could be and are customarily stored in tanks or transported in pipe lines were contemplated by the parties and intended to be included in the conveyance in the lease."

Therefore, it is quite apparent that unless the testimony clearly indicates that the parties to a lease contract intended that the above term includes sand, gravel, clay and the like products, its meaning is strictly limited.

The Law of Fellow Employes

In the case of Wilson v. Company, 78 S. C. 381, there were two gangs of laborers at work, each under a separate foreman, both of whom were under the direction of one boss in charge of all of the laborers. The one gang under Foreman Robinson was engaged in pushing a car loaded with phosphate rock along a track which led close to the door of a warehouse into which the rock was being discharged; the other gang under Foreman Sanders was engaged in shoveling up scattered phosphate rock from the space in front of the door of the warehouse.

A workman under Sanders was crushed by a car being pushed by the Robinson gang. In this case the Court held the workman was injured by a fellow workman, relieving the employer from liability, saying:

"There is not the least doubt, however, that the men who were pushing the car, including Robinson, who was the foreman, were fellow-servants of Wilson (injured employe). . . . These foreman had no power to hire laborers, provide machinery or the place of labor, or to do any duty imposed by law on the master. They were, therefore, fellow-servants of the deceased and the master is not responsible for their negligence."

In another leading case, Shirley v. Company, 57 S. E. 178, the Court explained the law, as follows:

"As one of the non-delegable duties of the master is to furnish a safe place to work, the master would be liable for any injury resulting to the servant from working in an unsafe place at the direction of any one authorized by the master, either directly or indirectly, to assign the servant to a place of labor. Conversely, if the servant was injured in consequence of working in an unsafe place, where he had gone on the order of a mere fellow-servant not authorized by the master to assign his place of labor, the master would not be liable, because with respect to the master, the fellow-servant undertaking to give the order would be a mere volunteer."

Still another United States Supreme Court case of importance is Al Moring Co. v. Whelan, 168 U. S. 86. The injured servant was one of a squad engaged in breaking rock and

preparing it to go in a chute, under the direction and control of a foreman. He was directed to break rock over one of the chutes, and while so engaged, the foreman drew the gate at the mouth of the chute, causing the rock at the head of the chute to be suddenly drawn in, carrying the employe with it, covering him with rock and debris and thereby greatly injuring him. The Court held the employer not liable, saying:

"Finley (the foreman) was not a vice-principal or representative of the corporation. He was not the general manager of its business, or the superintendent of any department of that business. But he was merely the foreman or boss of the particular gang of men to which the plaintiff (employe) belonged. Whether he had or had not authority to engage and discharge the men under him is immaterial. Even if he had such authority, he was none the less a fellow-servant with them, employed in the same department or business, and under a common head. There was no evidence that he was an unsuitable person for his place, or that the machinery was imperfect or defective for its purpose. The negligence, if any, was his own negligence in using the machinery or in giving orders to the men."

On the other hand, the risk that a safe place will become unsafe, or that safe machinery will become dangerous, by the negligence of the servants who use them, is one of the ordinary risks of the employment which the employes necessarily assume when they accept it.

Also, when it is shown that the working place originally, and when the employe was sent to do work there, was reasonably safe, but became unsafe at the particular time of the accident by causes that could not have been anticipated or by the neglect of a fellow-servant, the employer is not liable.

Therefore, the law is well established that while it is the primary duty of the employer to use reasonable care to provide his employes with a safe place in which to work, he is not liable for an unsafe condition resulting *from the manner* in which the workmen or fellow employes perform their work.

In other words, the *negligent* use by one fellow employe of *safe* equipment will seldom result in the master's liability. Such a legal rule would make any negligent act of a fellow employe, such as dropping tools about a factory, a breach of the employer's legal duty to provide a safe working place.

Generally speaking, an employer is liable for any injury to a workman which results from the latter's superior, boss or foreman. This is true because a superior is the employer's personal agent or representative, whereas a fellow employe does not represent the employer, nor act as his agent, with respect to other common workmen.

Moreover, an employer is not responsible for injuries resulting from the working place becoming unsafe *through the negligence of the workmen* if the employer discharged his primary duty of providing reasonably safe premises and appliances for his employes to carry on the work, and the foreman was not notified of the unsafe condition of the premises.

Generally speaking, the "working place" means the premises where the work is usually done, and does not comprehend any place where the employee goes without implied or expressed instructions from the employer or his agent. However, if an injury is sustained while an employee if off his employer's premises does not indicate that the employer is not liable, if the employee was acting within the scope of the employment when the injury was sustained.

Verbal Testimony Proves Amount of Purchase Price

Few persons realize that the money payment specified in a bill of sale or an assignment is not absolute or positive evidence that the purchaser paid this amount. In other words, either the buyer or the seller may prove that the consideration named in the instrument is incorrect.

For example, in Thatcher v. G. & M. Concrete Co., 280 Pac. 211, it was disclosed that a person named Thatcher purchased one-fourth interest in a gravel crushing plant and paid therefor $5,000 in money and 2,000 cubic yards of gravel. He received an assignment reading: "For one dollar and other valued consideration the G. & M. Concrete Company, Inc., herewith grant and convey back to G. M. Thatcher one-fourth (25%) interest in their gravel plant. . . ."

When controversy arose, the seller contended that the assignment was illegal because only $1,000 and other valued consideration" was specified as the purchase price. However, the Court permitted the purchaser to introduce verbal testimony showing that he had paid for his interest $5,000 and 2,000 cubic yards of gravel, stating the following important law:

"The consideration of the assignment of a personal chattel may be proven by parol, and a different one established than that expressed in the instrument . . . or the true consideration for a written release reciting a consideration of one dollar may be shown. . . . The seller of a business may, notwithstanding the recitals in the bill of sale with respect to its consideration, show by verbal testimony that the consideration in part was the agreement by the purchaser to pay an outstanding note of the seller . . . and it may be likewise shown that as a part of the consideration of the purchase of mortgaged property the grantee assumed the payment of the mortgage."

When Change of River Effects Boundary

In Wyckoff v. Mayfield, 280 Pac. 340, a dispute arose between two owners of adjoining gravel pits. The patent issued by the United States Government described the property of one owner as "laying north of the Rogue river." It was contended that the present ownership of the pits depended upon the location of the river when the patent was granted. However, one owner proved that the river channel suddenly changed and that this change increased the area of his pit.

It is interesting to observe that the Court held that gradual changing of the river's channel effects the legal boundary of the land, but that a sudden change does not. This Court said:

"It is settled law that a line running to the bank of a stream, or to the stream which is non-navigable, extends to the center or thread of the stream. . . . Addition to land by accretion, or loss by avulsion, causes the boundary to change with the change in the thread of the stream; but, *where the change is sudden and violent, the boundary remains the same*—that is, the thread of the stream as it was as originally surveyed. . . . By that sudden change of the channel of Rogue river the south boundary of plaintiff's land was not altered. The south boundary remains as it was prior to the sudden and violent change, and north of the disputed gravel pit; consequently, as a legal question, the gravel bed in dispute did not belong to plaintiff at the time the gravel was sold."

Trap Rock Plant To Be Modernized

The Burrell Engineering and Construction Company, Chicago, has been awarded the general contract for the modernization of the Clinton Point plant of the New York Trap Rock Company at an estimated expense of about $1,000,000. The erection of ten new buildings is in progress, these ranging in height from one story to fifteen stories. Old buildings will be dismantled and new machinery installed in the new buildings.

TRAFFIC NEWS AND COMMENT

New Complaints Filed With Interstate Commerce Commission

No. 22,577 Sub. 1.—Lehigh Portland Cement Co. Excessive rates, interstate and intrastate, on cement from Iola, Kans., to destinations in Arkansas and Louisiana, and unduly prefertial of competing points in Alabama, Indiana, Kansas, Kentucky, Louisiana, Missouri, Oklahoma, Tennessee, and Texas.

No. 22,855.—Neal Gravel Company. Against rate of $1 per ton on sand and gravel from Wolcottville, Ind., to Detroit, Mich.

No. 22,861.—Benjamin Moore & Co. Against rate of 29 cents per 100 pounds on talc, carloads, from Hailesboro and Emeryville, N. Y., to Bogota and Newark, N. J.

No. 22,873.—South Georgia Traffic Bureau. For rate not to exceed $3.83 per long ton in lieu of rate of $4.05 on shipments of phosphate rock, other than ground, from points in Florida to points in Alabama.

No. 22,882.—International Agricultural Corpn. Against rate of $5.80 per net ton on phosphate rock, crude or ground, from Mt. Pleasant and Wales, Tenn., to Texarkana, Ark.

Agricultural Limestone

The Western Trunk Line carriers are giving consideration to establishment of rates on agricultural limestone from Louisville, Neb., to destinations on the C. G. W., I. C., C. & N. W., C. St. P. M. & O., C. M. St. P. & P., and Wabash railroads.

The rates covered by Docket 496-P are to be based on mileage and the following illustrates the rates sought:

Miles	Rates in cents per 2,000 lb.
50	63
80	76
100	88
120	102

Coated Crushed Stone

Southern Freight Association, Docket 47,737 proposes, upon shippers' request, to revise the rates on crushed stone, coated with oil or asphalt, from High Bridge, Ky., to stations on the C. & O. Railroad in Kentucky.

It is stated that the proposed rates are made in relation to the rates now in effect to Catlettsburg and Morehead, Ky.

Talc or Soapstone

In Southern Freight Association Docket 47,880, a shipper has asked for establishment of commodity rates on talc and soapstone from eastern cities to Thomaston, Ga., in lieu of the present class rates. The rate sought from Boston is 43½c. From New York and Philadelphia, 41c. From Baltimore, 36c. These rates are to apply via rail and water routes.

Silica Rock

The Southwestern Lines have been requested by a shipper to publish new rates on silica rock from St. Clair, Mo., to points in Oklahoma.

In the Docket (Southwestern Freight Bureau Docket 18,649) the shipper asks that the rate to Ada, Oklahoma City, and Southard be made 16c; to Blackwell, Bristow, Henryetta, Muskogee, Sapulpa, 13½c; to Laughton 23c; and to Ponca City 14½c. It is stated that the foregoing rates are the same as now applicable on silica sand from Pacific, Mo.

Rates on Fuller's Earth

As a result of request by shipper, the Southwestern Lines in their Docket 18,711 are considering the revision of the rates on fuller's earth from Georgia and Florida points to destinations in the State of Texas.

It is stated that the rates proposed are in line with those prescribed by the Interstate Commerce Commission Docket 20,133.

Rates on Cement From Concrete and Portland, Colo.

The Southwestern carriers have under consideration reduction in rates on cement from Concrete and Portland, Colo., to various stations on the C. R. I. & G. Railroad. (Docket 18,749).

It is claimed that the following rates are in line with the basis prescribed by the Interstate Commerce Commission in its Docket 15,151:

To	Proposed Rate
Masterson, Tex.	$0.24
Willton, Tex.	.24
Greenough, Tex.	.24
Wilhelm, Tex.	.24
Deal, Tex.	.24½
Fritch, Tex.	.24½
Sanford, Tex.	.24½
Oil City, Tex.	.24½
Stinnett, Tex.	.24½
Pringle, Tex.	.25
Morse, Tex.	.25
Cator, Tex.	.25
Gruver, Tex.	.25
Bernstein, Tex.	.25
Hitchland, Tex.	.25

Fuller's Earth

In Southwestern Lines Docket 18,752 the carriers are considering a rate of $8.60 per ton on fuller's earth from Florida producing points, including Jamieson and Quincy, Fla., to Chanute and Humbolt, Kans., Burkburnett, and Wichita Falls, Tex.

Cement From Alabama Points to Points in Missouri and Kansas

Shippers of cement in the Birmingham district have asked the carriers to establish through rates to destinations in Missouri (south of the Missouri River) and Kansas, on the same scale of rates as now used in constructing rates to the more distant points in Arkansas and Oklahoma.

It is understood that in asking for the rates prescribed by the Interstate Commerce Commission in Docket 8,182, Scale 3 rates to apply to points in Missouri and Eastern Kansas and the Scale 4 rates to apply to destinations in western Kansas. (Southwestern Freight Bureau Docket 18,766.)

Rates on Lime From Marquette, Mo.

The Southwestern Freight Bureau, Docket 18,795, proposes a new line of rates on lime from Marquette, Mo., to destinations in the State of Illinois. The carriers are asked to establish an arbitrary of 3c per hundred pounds over the cement rates in effect from Ste. Genevieve, Mo.

The destination territory is that part of Illinois lying south of the Pennsylvania Railroad from E. St. Louis to Paris, Ill.

Rates on Silica Sand

One of the carriers operating in Southwestern territory has asked the Southwestern Lines to establish the same scale of rates on silica sand between points in Arkansas on the one hand and points in Kansas and Missouri on the other hand, also from points in Louisiana and Texas on the one hand and points in Kansas on the other hand, in line with the rates prescribed by the Commission in Docket 9,702.

It is desired to place the territory outlined above on the same basis as the surrounding territory according to Southwestern Lines. Docket 18,662.

Bituminous Rock Asphalt

Shippers of bituminous rock asphalt located at Eldorado Springs, Mo., and Nevada, Mo., contemplate the development of bituminous rock asphalt fields at those points and are asking that their rates be lined up with those

now in effect from Harwood, Mo. Their request, covered by Southwestern Lines Docket 18,724 asks that the following rates be established:

To	Rates in Cents per 100 lb.
St. Louis, Mo.	13
Chicago, Ill.	19½
Des Moines, Ia.	15
Lincoln, Neb.	15
Minneapolis, Minn.	20½
St. Paul, Minn.	20½
Cairo, Ill.	16½
Omaha, Neb.	15
St. Joseph, Mo.	12

They also ask that a mileage scale be authorized to destinations in Missouri and Kansas based on the following rates:

Distance	Rates in Cents per net ton
10 miles	96
10 and over 25 miles	107
100 and over 75 miles	142
150 and over 125 miles	176
200 and over 175 miles	199
250 and over 225 miles	222
300 and over 275 miles	257
400 and over 375 miles	303
500 and over 475 miles	349

Graphite Concentrates

The Southwestern carriers, in their Docket 18,675 propose to revise rates on graphite concentrates and graphite ore from Houston and Burnet, Tex., to various consuming points in the states of Iowa, Illinois, Indiana, Ohio, Pennsylvania and New York.

The following are typical of the proposed rates:

To	Rates per ton
Bloomington, Ill.	$10.30
Buffalo, N. Y.	13.10
Chicago, Ill.	10.30
Cincinnati, O.	10.30
Cleveland, O.	12.00
Detroit, Mich.	12.00
Freeport, Ill.	10.30
Gary, Ind.	10.30
Indianapolis, Ind.	10.30
Joliet, Ill.	10.30
Keokuk, Ia.	9.40
Milwaukee, Wis.	10.30
Muncie, Ind.	10.30
Niagara Falls, N. Y.	13.10
Niagara Falls, Ont.	13.10
Peoria, Ill.	10.30
Pittsburgh, Pa.	13.10
Saginaw, Mich.	12.00
Springfield, Ill.	10.30
Vincennes, Ind.	9.20
Waukegan, Ill.	10.30

Limestone Rates

The Interstate Commerce Commission has issued a decision in I&S Docket 3,288 in which it requires the carriers to cancel the increased rates recently proposed by them on limestone from points in Alabama to Southwestern territory.

Sand and Gravel

The Interstate Commerce Commission has instituted a general investigation known as Docket No. 17,000—Part 11-A.

This investigation concerns the rates and charges on sand, gravel, crushed stone, chat and related commodities taking the same rates, carloads, between points in Missouri, between points in Kansas and between points in Missouri and Kansas; the interstate rates and charges on the same commodities between points in Missouri and Kansas, on the one hand, and points in Oklahoma and Arkansas, on the other hand; and the relation between said interstate rates and charges applying on the same commodities between points within the states of Missouri and Kansas.

Gravel

In our issue of November 20 we referred to the controversy with respect to Louisiana state rates on gravel due to the orders of the State Commission being in conflict with that of the Interstate Commission.

The carriers instituted injunction proceedings which were heard and the court issued an injunction against the State Commission restraining said commission from enforcing its order directing the carriers to make lower rates on sand and gravel for use on public works which were lower than the rates established by the Interstate Commission for interstate movements.

Pending the final decree, the carriers are required to keep records which will permit refunds should the State Commission's rates be adjudged valid.

Virginia State Rates

By its decision of November 15, the Virginia State Commission has provided uniform scales of intrastate class rates to be filed by the carriers not later than February 1, 1930.

The new scales harmonize with that in Official and Southern Classification territories and will be governed by these major classifications.

Rates Suspended by Interstate Commerce Commission

Limestone

I&S Docket No. 3,379—Suspended schedules propose to increase from 42c to 55c, per ton of 2,240 pounds, the rates on furnace or foundry limestone in carloads, from Hillsville, Shaw Junction, and Halford, Pa., to Youngstown, O., and adjacent points.

Sand and Gravel

I&S Docket No. 3,381—Suspended schedules propose to reduce from 88c to 65c, per ton of 2,000 pounds, on sand and gravel from Munger and Spalding, Ill., to Hobart, Ind., and adjacent points.

Feldspar and Flint Rock

New England Freight Association Docket 18,183 proposes reduction in rates on feldspar and flint rock from Bates, Littlefield, Lockes Mills and South Paris, Maine, to Bordentown, Burlington, Elizabeth, Camden and various other points in New Jersey.

A shipper requests that the present rate of 22½c be reduced to 21c, which he claims is the rate now in effect from Bowdoinham, Maine.

Limestone

Trunk Line Association, Docket 22,207, covers proposal by shipper for revision of rates on limestone, ground or pulverized, from Pounding Mill, Va., to destinations located on the C. & O. Railroad in Kentucky and West Virginia.

Crushed or Ground Slate

A shipper has asked that the rates on crushed or ground slate from Cardiff, Md., Delta, Pa., Slate Hill, Pa., and Whiteford, Md., to Gloucester, N. J., be reduced to 18½c.

This subject is covered by Trunk Line Association Docket 22,212.

Cement

Trunk Line Association Docket M-1286 covers proposed reduction in rates on cement—common, hydraulic, natural or portland—to all stations on the Delaware Valley Railroad.

The rates sought are as follows:

From	Rate
All cement shipping points in Lehigh cement region	$0.11½
Brixment, N. Y.	.19½
Alsen, N. Y.	.15
Hudson, N. Y.	.15½
Binnewater, N. Y.	.14½
Hagerstown, Md.	.17½
Security, Md.	.17½
Martinsburg, W. Va.	.18
Universal, Pa.	.20½
Bessemer, Pa.	.20½
Chewton, Pa.	.22
New Castle, Pa.	.22
Swedeland, Pa.	.14½
Union Bridge, Md.	.17½
York, Pa.	.15½
Crescentdale, Pa.	.22
Wampum, Pa.	.22
Walford, Pa.	.22
West Winnfield, Pa.	.20½
Neville Island, Pa.	.21½

Cement

Central Freight Association Docket No. 22,041 proposes establishment of rates on common, hydraulic, natural or portland cement, carloads, from Bessemer, Wampum, Crescentdale, New Castle, Walford, West Winfield and Neville Island to stations on the S. N. Y. Ry., Oneonta to Mohawk, N. Y., inclusive. Rates ranging from 19c to 20½c per 100 pounds.

It also proposes rates from Martinsburg, W. Va., to the same stations, rates proposed being 18c and 19c per 100 pounds.

Sand

A shipper of sand at Wooster, O., has requested the carriers to propose a line of commodity rates on sand (blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing) to take the place of the present class rates.

MANUFACTURERS' PUBLICATIONS

Each publication listed below contains information of interest to non-metallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when making such requests.*

Buildings

"How to Stretch Your Building Dollar." 10 p., 6 ill. (*Ferguson Cross Section*, Nov., 1929. H. K. Ferguson Co., Cleveland, O.) Emphasizes four rules for safeguarding the building dollar: (1) The building should be designed for a specific period of use; (2) Anticipate future use; (3) Select the builder for his skill and standing —not on price alone; and (4) Buildings should be systematically maintained.

Car Dumpers

Link-Belt Rotary Railroad-Car Dumper. 8 p., 8 ill. (Book No. 1004, Link-Belt Co., Chicago, Ill.) Describes and illustrates a new type of car dumper, which handles cars from 26 to 60 ft. in length, 7 to 12½ ft. in height, 8½ to 11 ft. in width, and having capacities up to 120 tons.

Central Mixing Plants

"The Rodriguez Dam on the Tijuana River," 6 p., 8 ill. (*The Labor Saver*, Nov., 1929. Stephens-Adamson Mfg. Co., Aurora, Ill.) Describes the washing, screening, and mixing plants built for the Rodriguez Dam project in Lower California, Mexico.

Concrete-Block Machinery

"Makes Either Rock or Plain Faced Blocks." 1 p. 2 ill. (*Consolidated contact*, Nov., 1929. Consolidated Concrete Machinery Corp., Adrian, Mich.) Describes and illustrates a machine for making plain-face or rock-face blocks.

Conveyors

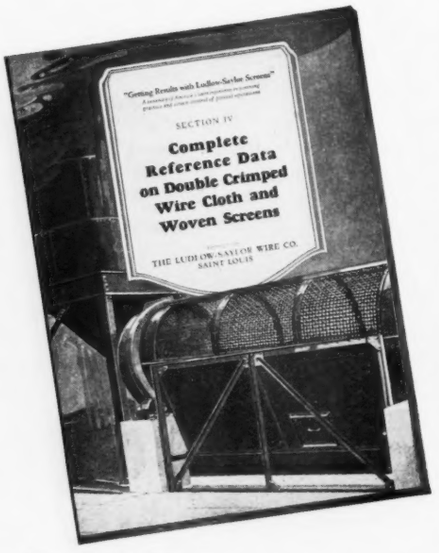
"Gloucester Electric Company . . . Doubles the Load in Summer Months." 4 p., 5 ill. (*The Labor Saver*, Nov., 1929. Stephens-Adamson Mfg. Co., Aurora, Ill.) Describes the conveyor method of handling coal from track hopper to coal-storage bunker.

Drilling, Blast-Hole

"Well-Drill Blasting Cuts Production Cost." 1 p., 1 ill. (*The Armstrong Driller*, Oct.-Nov., 1929. Armstrong Mfg. Co., Waterloo, Ia.) Describes the "face-shooting" problems of the Massachusetts Broken Stone Co.

Drill Sharpeners

Gardner-Denver Drill Sharpener, 8 p., 16 ill. (Bulletin DS-3A, Gardner-Denver Co., Denver, Colo.) Describes and illustrates Model DS-3A and a typical installation.


SECTION IV
Complete Reference Data on Double Crimped Wire Cloth and Woven Screens
THE LUDLOW-SAYLOR WIRE CO.
SAINT LOUIS

Dust Collectors

The Quarter-Century Mark. 8 p., 10 ill. (Pangborn Corp., Hagerstown, Md.) Announces the passing of the company's twenty-fifth year of successful manufacture of dust-collecting equipment.

Hoisting Engines

O & S Hoisting Engines. 32 p., 32 ill. (Catalogue 100-H, Orr & Sembower, Inc., Reading, Pa.) Describes and illustrates various types of gasoline, electric, and steam hoisting engines ranging in size from 3 to 80 hp. Bulletin A covers single- and double-drum gasoline hoists ranging in size from 5 to 30 hp.

Lighting

There Is One Best Way to Light Your Plant. 4 p., 11 ill. (AD2477, Benjamin Electric Mfg. Co., Des Plaines, Ill.) Illustrates typical examples of modern lighting installations.

Motors

G-E Super-Synchronous Motors for Large Grinding and Pulverizing Mills. 4 p., 5 ill. (GEA-1172, General Electric Co., Schenectady, N. Y.) Describes and illustrates various applications of synchronous motors driving tube, finish-grinding, and ball mills.

Pipe

Arc Welding of Pipe Lines. 12 p., 23 ill. (G15, Lincoln Electric Co., Cleveland, O.) Describes and illustrates use of electric-arc welding in installing large metal piping.

"Templet for Bends in Large Pipe." 1 p., 2 ill. (*Oxy-Acetylene Tips*, Nov. 1929. Linde Air Products Co., New York, N. Y.) Describes a novel method of making bends in large pipe.

Quarrying

"New System of Quarrying at Monolith California Plant." 1 p., 2 ill. (*Monolith Mixer*, Nov., 1929. Monolith Portland Cement Co., Los Angeles, Cal., Monolith Portland Midwest Co., Denver, Colo.) Describes the new tunnel-quarrying methods in use at Monolith.

Screens, Wire-cloth and Woven

"Complete Reference Data on Double-Crimped Wire-Cloth and Woven Screens." 36 p., 167 ill. (Sec. IV, p. 107-142, of *Getting Results with Ludlow-Saylor Screens.* Ludlow-Saylor Wire Co., St. Louis, Mo.) Illustrates the use of wire cloth in filters, separators, screens, mills, etc.

Signs

The Adventures of "Careless" and "Thotless" (Stonehouse Signs, Inc., Denver, Colo.) Bulletin 1060-A (4 p., 37 ill.) deals with no-admittance signs; Bulletin 1060-B (4 p., 48 ill.) with machine-hazard signs; Bulletin 1060-C (4 p., 23 ill.) with eye-hazard signs; Bulletin 1060-B (4 p., 50 ill.) with first-aid and sanitation signs; Bulletin 1060-E (4 p., 38 ill.) with traffic-hazard signs; Bulletin 1060-F (4 p., 54 ill.) with falling-hazard signs; Bulletin 1060-G (4 p., 38 ill.) with electrical-hazard signs; Bulletin 1060-H (4 p., 24 ill.) with fire-hazard signs; Bulletin 1060-I (4 p., 32 ill.) with efficiency signs; Bulletin 1060-J (4 p., 30 ill.) with no-smoking-hazard signs; and Bulletin 1060-K (4 p., 47 ill.) with elevator-hazard signs.

Stokers

Green Chain Grate Stoker (Natural Draft). 28 p., 32 ill. (Catalogue GND-2, Combustion Engineering Corp., New York, N. Y.) Describes and illustrates mechanical stokers for burning the screenings from all grades of non-coking or moderately-coking bituminous coals, high-ash coals, and many lignites.

Switches

Westinghouse Safety Switches. 72 p., 254 ill. (Catalogue 282, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.) Describes and illustrates various types of industrial safety switches, motor-starting switches, meter-service switches, wiring devices, etc., and includes wiring data and the National Electric Code (1928) regulations on switches and motor protection.

Tractors

Caterpillar Magazine (issue 43). 16 p., 48 ill. (Caterpillar Tractor Co., San Leandro, Cal.) Illustrates numerous interesting applications of crawler-type tractors.

REVIEW OF FOREIGN PRACTICE

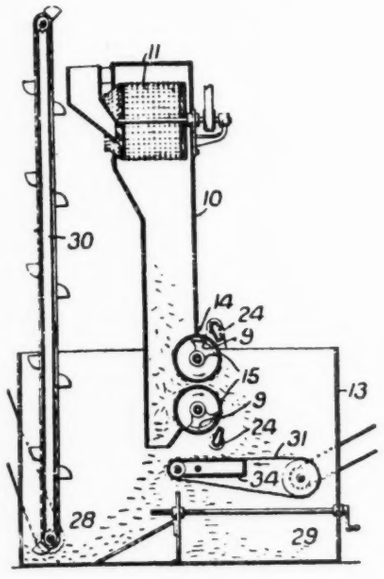


Fig. 1

Mica

Mica flakes are separated according to their thickness by dropping the mixed flakes down a tower 10 and applying suction at an opening 14 so as to remove those of the required thinness and flexibility. The thicker flakes drop into one compartment 28 of a bin 13 and may be subjected to further disintegrating and separating operations and the selected flakes, before collection in the compartment 29, may be subjected to a further grading by suction apparatus. In the apparatus described, Fig. 1, the mica blocks, after being soaked in a mixture of soapstone and water and dried, are fed to a reticulated drum 11 which disintegrates the blocks, the flakes falling through the meshes into the tower. The suction device at the foot of the tower comprises two oppositely rotating perforated drums 15 in the interior of which is produced a partial and regulated vacuum. The flakes adhering to the drums are carried out of the tower and are stripped by the action of tangential air blasts from elongated nozzles 24 in combination with stationary segmental cutoffs 9.

The flakes carried out of the tower are dropped on to a perforated endless carrier 31 under the forward end of which is placed a suction box 34, which acts in combination with the centrifugal action of the carrier 31 to make a further selection of the flakes which fall into the compartments 28, 29 of the bin. An elevator 30 returns the thick flakes to the drum 11 for retreatment.—L. T. Frederick, British Patent 317,553.

Impact Pulverizers

Apparatus for pulverizing and separating cereals, minerals, etc., comprises a separation chamber 14 (Fig. 2) above the pulverizer and connected to the latter by a pair of conduits 16, 17 formed by dividing the trunk 13, the ground material passing by air suction up to the conduit 16 into the chamber 14 and the heavier material falling back into the pulverizer through the conduit 17. A second separating chamber is formed in the trunk by the insertion of a member 19 so that the lighter material from the first separation is subdivided, the heavier portion returning by a conduit 21 to the conduit 13 and the lighter portion to a styving chamber 32 through a valve 26. The mill comprises a chamber 3 within which rotates beaters 6, the material being fed to the mill through a hopper 4. A deflector plate 18 is provided in the separating chamber 14 and regulator plates 22, 24 are formed in the conduits 21 and 17 respectively. The degree of fineness of the ground material is regulated by the opening of the valve 26. The mill may have one or more pulverizing chambers.—H. A. Livingstone. British Patent 316,922.

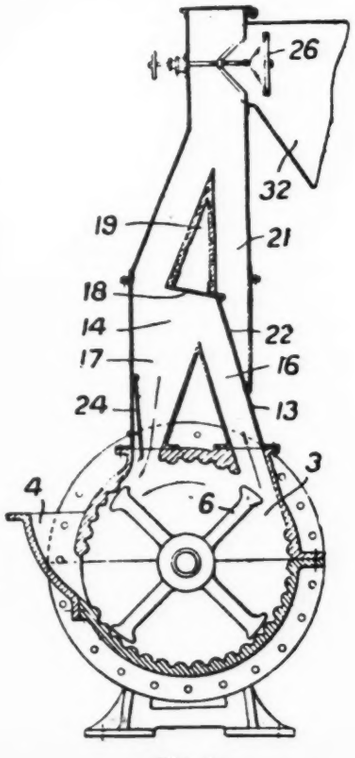


Fig. 2

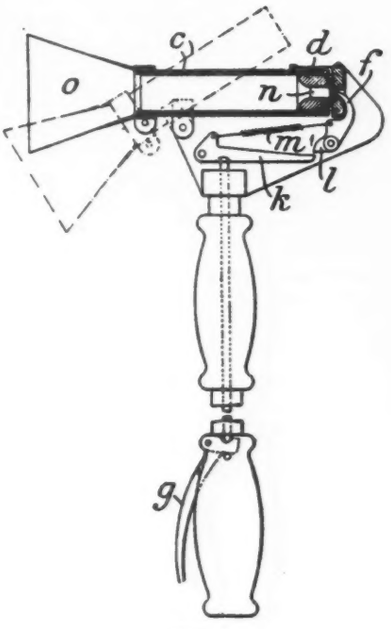


Fig. 3

Cement Guns

Cracks or crevices in stone, brick or concrete structures or in linings for furnaces or chemical vessels are filled by injecting cement by means of an explosive as described in specification 313,728. A device for use with a cartridge consists of a pivoted barrel portion *c* (Fig. 3) with an enlarged opening *o* closed at the back end by a breech block *d* for supporting the cartridge *n*, which is fired by a hammer *f* operated through levers *k* from a hand lever *g*. The levers are reset by a spring *m* on release of the hand lever.—Woodall-Duckham and A. M. Duckman. British Patent 317,595.

Factors Influencing the Strength of Concrete

Quality of coarse aggregate, quality of fine aggregate, quality of cement, quality of water, adulterants, ratio of coarse aggregate to fine, ratio of total aggregate to cement, ratio of water to cement, amount of consolidation, curing and temperature.

Good quality coarse aggregate should be: (a) chemically inert, (b) structurally sound, (c) clean. Other qualities, such as grading and porosity, have their effects, but not suf-

ficient however to make the difference between "good" and "bad" concrete. In fine aggregate, similar qualities are naturally essential, but the chemical inertness and cleanness are of greater importance than with coarse aggregate.

Chemical Inertness. An aggregate which is in itself subject to spontaneous decomposition, or one which decomposes by the agency of the cement, is definitely unsuitable. Fortunately, practically all the naturally occurring rocks are free from these defects, although bituminous coal may be considered in this category. Among aggregates obtained artificially, certain qualities of blast furnace slags are noted offenders, as are also Fletton bricks, and in each case the trouble is traceable to the presence of sulphur compounds. J. E. Worsdale, London. *The Structural Engineer.* October, 1929.

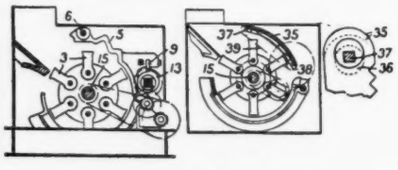
Effect of Tannic Acid on Strength of Portland Cement

In an investigation on the effect of organic impurities on the mechanical properties of portland cement, reported by F. Few in *Chemical Engineering & Mining Review,* Melbourne (21:441-443, Sept., 1929), tannic acid was selected as the impurity in loam that causes harmful effects in the hardening of the concrete, and a series of tests were run with 1:3 mortars, with uniform 10 per cent water, and with additions of 0, 0.1, 0.2, 0.3, 0.4 and 0.5 per cent of tannic acid in solution in the mixing water. The averages on tensile strength after 7 days were 297 lb./sq. in. without tannic acid, 294 lb. with 0.1 per cent tannic acid, 249 lb. with 0.2 per cent, 184 lb. with 0.3 per cent, 182 lb. with 0.4 per cent and 138 lb. with 0.5 per cent; after 28 days the tensile strengths were 344 lb. per sq. in. for the mortar without tannic acid, 319 lb. for 0.1 per cent, 302 lb. for 0.2 per cent, 282 lb. for 0.3 per cent, 280 lb. for 0.4 per cent and 243 lb. for 0.5 per cent, all cases thus showing the weakening effect of the acid impurity.

Tests on 3-in. by 3-in. cubes for compressive strength were not so clear, the 7-day results being breaking strengths of 18,675 lb. for the pure mortar, 22,275 lb. for 0.1 per cent tannic acid, 12,875 lb. for 0.2 per cent, 10,010 lb. for 0.3 per cent, 6,950 lb. for 0.4 per cent and 5,960 lb. with 0.5 per cent acid; breaking strengths at 28 days were 17,550 lb. for the cube with no acid, 21,200 lb. for the batch with 0.1 per cent, 20,725 lb. with 0.2 per cent, 17,350 lb. for 0.3 per cent, 17,160 with 0.4 per cent and 15,410 lb. for 0.5 per cent. Thus in both the 7 and 28-day tests there was an increase in compressive strength for the batch with 0.1 per cent tannic acid as compared with the batch with no acid —a result for which the investigator is unable to account at least without further investigation.

The Packing of Cement

Before the war, jute sacks were used (in Germany) to pack cement. These were satisfactory, but due to the loss of the German colonies became too expensive. The jute sacks were porous, and the cement contents were properly aired. Too-quick setting ingredients were automatically air slaked. The modern paper sacks now in use are risky for fresh cement. The product is contained in an atmosphere of damp heat, which is less favorable than dry heat. The free penetration of dry air must be prescribed for any container of portland cement. This is true of barrels, but not of paper bags. Cement which has been packed and stored in paper bags should be shoveled in the air before being added to the mixer, in order to convert the quick setting ingredients into "normal setters." This time of exposure should be one half a day. Experiments were run with no definite result on the commercial feasibility of using porous materials such as linen, hemp or other fabric with porous texture. As these materials are expensive, the possibility is mentioned of using boxes, as being more porous and more satisfactory than paper. — Heinrich Luftschitz (*Tonindustrie Zeitung,* Oct. 21, 1929).



Figs. 4 and 5

New Japanese Standards for Portland Cement

The fineness of division shall be such that not over 12 per cent will remain on the 4,900 mesh per sq. cm. sieve. A specific gravity of not less than 3.05 is required. The cement may contain not more than 2 per cent SO_3 or 3 per cent MgO. The loss on ignition may reach 4 per cent and foreign additions are permitted to the extent of 3 per cent. The initial set shall take place in not less than one hour, and setting should be complete in not more than 10 hours, at a temperature of from 15 to 25 deg. C. The 28-day strength shall be 355 lb. per sq. in. (tensile) and 4,260 lb. per sq. in. (compressive). The weight of a sack of cement shall be 110 lb. net, and of a barrel 374 lb. net.—K. Bergt, Nanao, Japan. (*Zement,* Oct. 17, 1929).

Grinding or Crushing Mills

In a mill for crushing wet clay or coal, a crushing surface 5, Fig. 4, against which the material is disintegrated by hammers or beaters, 3, comprises a plurality of pivotally mounted elements which are moved intermittently from their normal position and are restored thereto by the action of springs or gravity, or each end of the members 5 may be mounted eccentrically so that upon rotation of the eccentrics the members move in parallel planes. The crushing surface, 5, Fig. 5, comprises members each pivoted to a bar 6, the free ends of the members resting on cams 13 through the medium of a wear-resisting strip 9. The cams 13 are rotated by gearing which may be connected with the mill shaft 15. The member 5 may have its end lifted by a ratchet wheel, the return movement being completed by a spring. In Fig. 4, the crushing surface 35 has each end mounted on eccentrics 36, Fig. 5, carried by shafts 37, 38, the two shafts being connected by a chain 39 and operated by gearing connected to the mill shaft 15. Alternate eccentrics on the shafts 37 are disposed at 180 degrees apart so that the members 35 have a differential movement in parallel planes.—J. Y. Johnson. British Patent 317,208.

Towboat and Barges Ordered By Chattanooga Company

To augment its present fleet, The Dixie Sand and Gravel Company of Chattanooga, Tenn., has placed an order with The Howard Ship Yard and Dock Company of Jeffersonville, Ind., for the largest towboat ever on the upper end of the Tennessee river. It is a stern-wheeler, of steel construction, 146 ft. in length with a 30-ft. beam, and 5 ft. 2 in. deep. Its four boilers will drive an engine with a 18-in. bore and a 6-ft. stroke, and will tow four barges a distance of 36 miles from the scene of their present dredging operations. As this is exclusively a towboat, the cabin will accommodate only the crew.

In addition to this towboat, six all-steel barges have been ordered from the Nashville Bridge Company, Nashville, Tenn., each of which will be 133 ft. by 29 ft. and 7½ ft. deep. The additional equipment will prevent recurrence of difficulties experienced this year, when considerable business was turned down on account of inability to make deliveries.

LATEST NEWS FLASHES

Cement Company to Enter Sand and Gravel Field

According to press dispatches, the Northwestern Portland Cement Company has purchased a site on Maury Island for the purpose of producing sand and gravel on a large scale. Plans for a modern plant are being prepared by Link-Belt engineers, it is reported, and construction work is to be started in the near future.

Maury Island is located in Puget Sound, 20 miles south of Seattle and 10 miles north of Tacoma and for years has been the source of some of the finest sand and gravel produced in that area. The new plant, when completed, will have a production capacity of more than 400 cubic yards per hour, it is said.

Headley Company Announces Change of Name

The Headley Emulsified Products Company, on October 1, became the successor to Headley Good Roads Company of Philadelphia, which for 21 years has manufactured emulsified asphalt products. The new company will expand its line to cover all of the following industrial uses: highway construction and maintenance, railroad platforms and crossings, waterproofing, dampproofing and protective coatings for all types of structures.

Dixie Mineral Contemplate New Plant

The Dixie Mineral Products, Inc., with headquarters in Chattanooga, Tenn., produces bleaching clay, talc, white tripoli, and silica which are secured at various localities and milled at Evansville, Tenn. A new plant is being contemplated for erection in Chattanooga, according to James G. Kalanzis, president.

New Silica Plant at Tatesville Nearly Completed

The new plant of the Pittsburgh Silica Sand Company under erection at Tatesville, Pa., is expected to be ready for production about the first of January, according to information received from Thomas MacConnell, Jr., president.

Form Asbestos-Talc Company

The Asbestos-Talc Products Company, capitalized at $23,000, by a group of Skagit County, Wash., residents, was recently granted articles of incorporation. The company plans to develop recently discovered deposits of fibre asbestos and talc in Skagit County, it is reported.

Report Asphalt Deposits

Geologists of the University of Oklahoma are said to have reported extensive asphalt deposits of good quality in south, central and southeastern Oklahoma near the Texas border. The investigation was made for the Oklahoma geological survey.

American Potash Erects New Buildings at Trona, Calif.

The American Potash and Chemical Corporation has just completed an extensive building program at its Trona, Calif., plant in the Slate Range mining district. Included in the new construction is a 3-story administration building of concrete, 50 ft. wide by 106 ft. deep.

Rich California Sulphur Beds Soon to be Mined

Sulphur beds located 15 miles north of Healdsburg, Calif., on the property of the Geysers Development Company, are soon to be mined and first shipments are expected to be made before the end of the year, according to newspaper dispatches from the West Coast.

Arthur J. Crowley, mining and metallurgical engineer, who recently completed an extensive study of the deposits, has reported that the ore is rich and lies in a "blanket" form on the surface, permitting production at an unusually low cost.

John D. Grant is president of the Geysers Development Company. Robers Berring and Frank Woods, both of Los Angeles, and J. B. Foppiano of Healdsburg form the board of directors.

Phoenix Sand and Gravel Plans Another Large Plant

The Phoenix Sand and Gravel Company, operating a gravel plant at Bagnell, Mo., has plans under way for another large plant and has acquired an island in the Osage river, near Bagnell. The new plant will ultimately handle 100 carloads of gravel daily, reports say. Two 600-hp. electric units, driven by Fairbanks-Morse diesel engines will be installed.

Cement Company Changes Name

At a recent directors' meeting, held at Detroit, decision was made to change the name of the Peerless-Egyptian Cement Company to the Peerless Cement Corporation. The number of shares of common stock outstanding was reduced from 1,200,000 to 240,000, or on a basis of one share for five. A dividend of $1.00 per share on the new stock was declared, this being at the rate of 20 cents per share on the old shares.

Plan Mica and Feldspar Plant at Las Tablas, N. M.

According to Phillip H. Hoyt of Las Tablas, N. M., construction of a $40,000 mill at the Las Tablas mica and feldspar pits will begin in the near future. Construction is contingent, however, upon the securing of a rate of $6.50 per ton on ground and crude feldspar from Las Madera and Servilleta to points on the west coast and the Mississippi river, it is said.

Zonolite Producing 100 Tons Daily at Libby, Mont.

Zonolite, a non-metallic mineral composed of silica, magnesia and alumina, is being produced on a commercial scale by the Zonolite Company at Libby, Mont. The company owns large deposits and is operating at a capacity of 100 tons per day. The material has found wide use for insulating and fireproofing. Being lighter in weight than cork, in its expanded form, it is used as a cork substitute with marked success. The company's shipments have not been confined to this country. Large tonnages are being shipped to Japan, Germany, France and England.

Canada Cement Plant to Adopt Wet Process

Plant No. 1 of Canada Cement Company, Ltd., at Montreal, is shortly to be converted to the wet process and has placed orders with F. L. Smidth and Co., cement plant engineers, for four Unax rotary kilns, equipped with Unax coolers. Other equipment to be purchased will practically rehabilitate the burning and raw mill facilities of the plant.

Young Radiator Company to Enlarge Plant

Anticipating increased production in 1930, the Young Radiator Company, manufacturers of copper heat transfer products, has installed additional machinery at its Racine, Wis., plant. According to F. M. Young, president, when the enlargement program is complete, the company's manufacturing facilities will be double the former capacity of the plant.

Geo. D. Whitcomb Builds Addition to Factory

The Geo. D. Whitcomb Company, manufacturers of industrial and railway locomotives, has just completed an addition to its factory at Rochelle, Ill. The additional space will be used primarily for the manufacture of oil, electric and large gear drive locomotives. The company also plans an addition to its office, as well as another plant extension early next year.

Coos River Quarry Closes For Winter Months

The rock quarry on Coos river near North Bend, Ore., which has been supplying crushed rock for the Coos Bay jetty construction, closed down a few days ago. Quarrying and crushing operations will be resumed again next March. More than 250,000 tons of rock were handled during the past season. The Hauser Construction Company operates the plant.

Renshaw and Ratchford Order Machinery for New Plant

Renshaw and Ratchford, basalt quarry operators at Alturas, Cal., are expanding operations and have placed orders for a crusher, washing equipment and a steam shovel, preparatory to operating a sand and gravel plant directly east of the city of Alturas. The basalt plant west of the city, which was described in an article on page 97 of the November 5, 1929, issue of PIT AND QUARRY, will continue to operate as heretofore.

L. G. Renshaw, who made the announcement of the acquisition of the sand and gravel pit, reports that the new plant will have a capacity of 250 cu. yd. per day.

Lockwood Hill Organizes New Equipment Firm

Lockwood Hill, for the past 10 years a member of the firm of Blockman-Hill Company, has organized his own company, to be known as the Hill Equipment Engineering Company. Offices have been established at 4620 Delmar Blvd., St. Louis.

Lockwood Hill

Mr. Hill is a pioneer in the arc welding field. After his graduation from Cornell in 1909, he became associated with the General Electric Company, serving in its testing, foreign and sales departments. He was later attached to the St. Louis district Ordnance Office of the U. S. Army.

The new organization will have the exclusive sale of the products of The Lincoln Electric Company and the Baker Industrial Truck Company in the St. Louis area.

Exhibit Improved Wheeling Crushers at Road Show

W. H. Sallwasser will be in charge of the exhibit of the Wheeling Mold and Foundry Company at the annual convention and road show of the American Road Builders' Association at Atlantic City, January 13 to 18. The company will exhibit improved models of three of its roller bearing crushers. New features include Alemite lubrication on all moving parts and dust-proof bearing housings.

Manganese Steel Forge Company Discontinues Cleveland Office

Manganese Steel Forge Company, manufacturers of Rol-Man screens and other rolled and forged manganese steel products, has discontinued its Cleveland office. The territory formerly served by this office is being handled by the company's Pittsburgh office. P. M. Hobbs, of the Cleveland branch, has been transferred to Chicago, where he has taken charge of the company's office at 228 N. LaSalle St. W. H. Potter, former Chicago manager, goes to the main offices of the company at Philadelphia, where he becomes general sales manager.

Dolomite Materials Company Changes

The Dolomite Materials Company and associate dealers in sand, gravel and crushed stone, recently changed corporate name. In the future they will be known as the Lake Ports Supply Company. The company sells the above named aggregates, as well as cement, in most of the principal cities and towns on the Great Lakes.

Good Roads Moves Offices

The Good Roads Machinery Company has moved its Chicago sales and engineering offices to No. 1821 Builders Building. These offices are under the supervision of H. G. Brown and M. A. King. The company retains its warehouse of supplies and equipment for a ready response to the needs of the Chicago area.

New Corporations

Dicalite Co., c/o Swanwick & Donnelly, Calif. Bank Bldg., Los Angeles, Calif. 10,000 shares. Gypsum, lime, cement.

Smith Sand & Gravel Co., J. Wesley Smith, Lakeview Blvd., West Palm Beach, Fla. $10,000. I. H. Smith, same address; W. W. Lottridge, 954 Andrews Rd., W. Palm Beach. To operate at Orlando.

River & Sand Supply Co., c/o Joseph Lareault, 642 Church Ave., Verdun, Que., Can. $74,750.

Asbestos-Talc Products of Wash., Inc., C. R. Buck, Mt. Vernon, Wash. $23,000. E. A. Alm, H. D. Williams, W. A. George. To conduct mining operations.

Copper Cities Lime & Stone Construction Co., H. E. Hoopes, Miami, Ariz. $100,000. R. V. Hoopes, A. R. Edwards. Will take over the four lime kilns which have been operated for the past four years by H. E. Hoopes.

Atlantic Lime Rock Corp., F. Pembroke Pope, Washington, Ga. $30,000.

Beacon Hill Gravel & Land Co., Inc., Edw. Farry, Jr., Keyport, N. J. 1000 shares com.

Camden Gravel Co., Geo. K. Force, Pres., Reader, Ark. $20,000. Andy R. Taylor.

Joplin Sand Co., H. J. Joy, Joplin, Mo. $5,000. William Meyer. To produce sand.

Cadiz Limestone Products Co., Oliver Monaco, Germano, Ohio. 500 shares n.p.v. Raphael G. Monaco, Michael Erdos, E. S. McNamee, Cadiz, Ohio.

NEW MACHINERY AND SUPPLIES

New model of truck

New Truck Model Offered In Three Wheelbase Sizes

The Relay Model 50D rated 2, 2½, and 3, has been placed on the market by Relay Motors Corporation of Lima, O. This is the first truck addition to the Relay line since the 1-ton 20B and 1½-ton S11B were announced. The new model is being built in three wheelbase sizes, 139½, 161, and 185 inches. On the 139½-in. chassis it is particularly adaptable to dump truck operation where short turning radius is a necessity, according to the manufacturers.

The engine, a six-cylinder model, has a 330-cu. in. piston displacement, and has an S. A. E. rating of 33.75 hp. The transmission has five speeds forward and two in reverse. Service brakes operate on all four wheels, while the hand brake contracts on the propeller shaft. The rear axle embodies the Relay pendulum suspension. This type of axle differs from the conventional design, in that the weight of the body and load are carried at a distance from the center of the wheel.

Build Boom For Attachment To Caterpillar Tractors

One of the latest products of the W-K-M Company, Inc., of Houston, Tex., is the W-K-M boom for attachment to caterpillar tractors, models 20, 30 and 60. One of its outstanding features is that its application in no way hampers the use of the tractor on drawbar work. As a portable loading unit it lifts and carries loads of 4,500 lb. with ease, using 2,000-lb. counterweights. Field installation is quite simple and two men can easily attach the unit in four hours. No drilling or cutting of any kind is required.

Power is obtained from the rear of the tractor by means of a specially designed take-off unit and is passed to the main shaft by heavy chains.

Diesel Operated 25-Ton Crane Proved By Performance

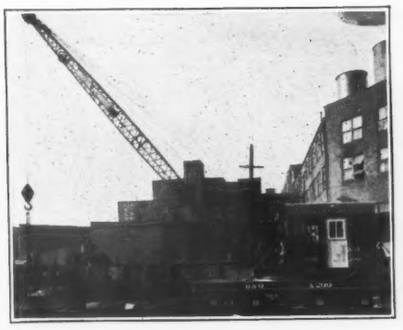
A diesel operated, 25-ton-capacity locomotive crane has been announced by Industrial Brownhoist Corporation of Cleveland. These cranes, the first of this capacity to be powered by diesel engines, have been fully demonstrated before groups of engineers from a number of the country's leading railroads, steel mills and industrial plants and, in every case, their performance has proved highly satisfactory.

The diesel engine on this new Industrial Brownhoist is of the six-cylinder, two-cycle, solid-injection type and burns any ordinary grade of fuel oil. The entire operating mechanism is mounted on a one-piece cast-steel rotating bed and the side frames are also made of steel castings. The power take-off from the engine is fully enclosed, runs in oil and is equipped with Timken roller bearings to minimize friction and make the crane quiet in operation.

Portable Paving Plant

A mobile asphalt paving plant designed to handle 1,000-lb. batches at about 75-second intervals and capable of mixing batches up to 1,500-lb. each by weighing off twice to the mix, is announced by the Madsen Iron Works, Huntington Park, Cal.

The plant is not new in basic principles, as it is the 1,000-lb. standard

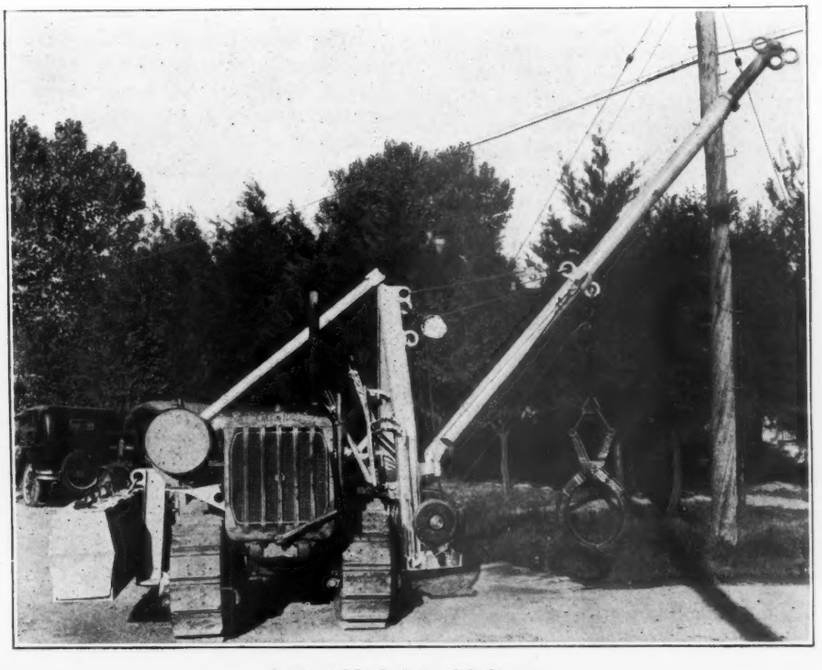


Diesel-driven industrial crane

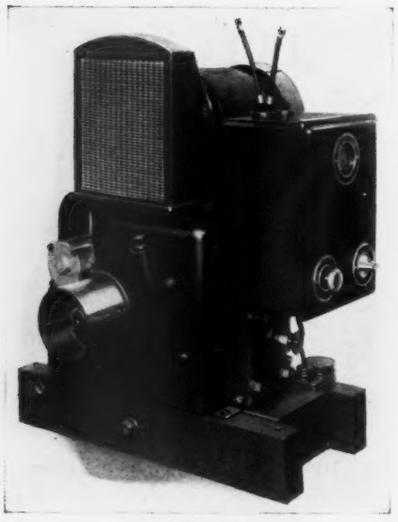
plant which this company has been building for ten years, re-designed to secure complete portability. This is said to have been accomplished to a degree where contractors may now profitably set up this plant for a 10-day or 15-day run.

The plant is built in two units. To avoid loading the main plant chassis beyond legal load limits, a separate trailer unit has been provided, on which are mounted a 25-hp. steam boiler, 10-ton steam-heated asphalt tank, 200-gal. water tank, 400-gal. fuel tank, and asphalt, fuel and boiler feed-pump.

Provision has been made for driving the plant either by electric motor, or with gas, gasoline, or oil engine. A 50-hp. motor is standard equipment, but the outer end of the main shaft is extended to accommodate a belt pulley for driving by a 75-hp. engine when electricity is not available.



Portable hoist with boom



Lighting unit

Compact Plant-Lighting Unit

To meet a growing demand on the part of contractors for a dependable source of power to supply illumination for night work, Fairbanks-Morse & Company has developed a compact self-contained light plant that is finding favor because of its simplicity of design and reliability of operation.

Particularly is this unit adaptable for use on cranes, dredges and excavating equipment to supply the adequate illumination that is required on jobs which necessitate 24 hours a day operation. It is generally not feasible to operate a lighting generator from the main power unit because of the extreme speed variations due to radical load fluctuations which occur on this unit and consequently cause violent voltage fluctuations which in turn, of course, produces a bad flicker in the light.

The plant comes in two sizes of 750 and 1,500 watts capacity respectively. In the assembly and power unit, the ignition system, the generator end and the control mechanism are maintained as separate units not being tied up in any way that introduces complication. The engine used is the Fairbanks-Morse Self Oiling "Z" engine with high tension magneto ignition. The smaller 1½-hp. unit is designed to operate on gasoline as fuel while the larger 3-hp. engine can use either gasoline or kerosene. The generator is a ball-bearing machine mounted as a unit directly above the engine. A Flex-Mor "V" belt type drive is used.

Wheeled Scoops of Huge Proportions

Engineers of the W. A. Riddell Company, Bucyrus, Ohio, have designed and developed a new wheeled scoop of gigantic proportions.

This new scoop is carried by two huge land wheels 66 inches in diameter and with 10-inch rims. A heavy bowl or pan is supported upon a full length, one piece, axle, forged from nickel steel. This axle is arched high in the center to afford maximum loading space in the bowl. The wheels are Timken bearing mounted and are equipped with clutch housings which contain clutches of the progressive internal expanding band type. The clutches and Timken bearings are thoroughly enclosed.

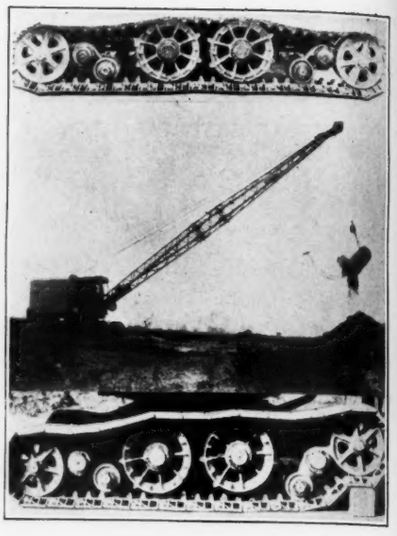
These scoops, which are of 2-cu. yd. capacity, level full, are operated in the same manner as the smaller 1-cu. yd. scoops. A lever and a latch are the only controlling mediums necessary.

The new scoops are operated in trains of two or more, depending entirely upon the tractor's power. The ordinary 10-ton type tractor will operate 3 of the model "T" or 2-cu. yd. scoops without difficulty. According to the manufacturers, a train of the scoops can be turned in a highway 20 feet wide. The operations of the scope are continuous, as it is not necessary to stop the tractor to either load or dump. When operating in trains, the functions of the various scoops are controlled from a loading platform on the leading scoop through hand lines, by one man.

New Tread Center Drive Crawler

New improved center drive crawlers are announced by The Thew Shovel Company, Lorain, O., for its line of product—the ¾-cu. yd. Lorain-45, 1-cu. yd. Lorain-55 and 1¼-cu. yd. Lorain-75.

The most radical development is represented by the new "64" and "68" tread crawlers. The numerical designation of the crawlers comes from the number of treads in the self-laying tracks. Basically they are the standard "52" and "56" tread crawlers—plus. Instead of the standard single end rollers, equalizer rocker arms

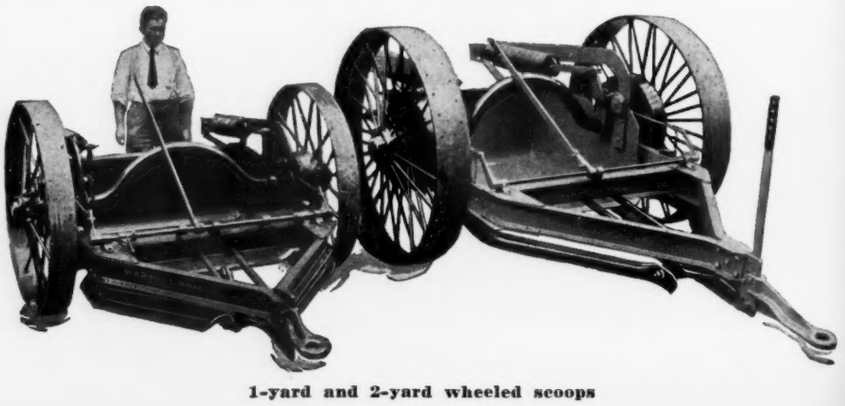


Improved crawler

each carrying a large end roller and a small intermediate load-carrying roller are mounted on the end axles. This places the large end rollers in advance of the end axle and increases the overall length from 12 per cent to 29 per cent on the various units. The resulting greater supporting area also gives reductions of ground pressures that average from 15 per cent to 25 per cent.

In addition to the materially reduced ground pressures, the action of the equalizer rocker arm is such that the tendency to "dig-in" is eliminated. The distribution of the end axle load to its rollers is such that the smaller or rear roller carries the greatest load, the effect on the front end roller being to climb or nose-out of soft materials.

Complete details on the new center drive crawler are contained in a new booklet "The 52-56-64-68 Tread Center Drive Crawlers," a copy of which may be had by addressing The Thew Shovel Company, Lorain, O. Visitors at the Road Show at Atlantic City January 13 to 18 will have the opportunity of seeing and examining the new crawlers.



1-yard and 2-yard wheeled scoops